

2022 -23



केन्द्रीय विद्यालय संगठन,  
एर्नाकुलम क्षेत्र

**KENDRIYA VIDYALAYA SANGATHAN**

**ERNAKULAM REGION**

**CBSE CURRICULUM**

Artificial Intelligence (417)

**CLASS X**

**STUDENT SUPPORT MATERIAL**



केन्द्रीय विद्यालय संगठन,  
एर्नाकुलम क्षेत्र

**KENDRIYA VIDYALAYA SANGATHAN  
ERNAKULAM REGION**

**Artificial Intelligence (417)**

**CLASS X**

**STUDENT SUPPORT MATERIAL**

**2022-2023**

## **PATRON**



Mr R Senthil Kumar  
Deputy Commissioner (KVS RO, Ernakulam)

## **COURSE DIRECTOR**



Mrs Deepti Nair  
Assistant Commissioner (KVS RO, Ernakulam)

## **ASSOCIATE COURSE DIRECTOR**



Mrs Hema K  
Principal, K V NTPC Kayamkulam

### **Resource Persons :**

Mrs K Vimala Thomas, PGT CS , K V INS Dronacharya

Mrs Ambili Krishnan, PGT CS , K V Pallipuram

Mrs Sheena B R , PGT CS, K V Pallipuram

### **Contents prepared by**

PGT CS and Computer Instructors of Ernakulam Region

आर सेन्धिल कुमार  
उपायुक्त

*R. Senthil Kumar*  
Deputy Commissioner



केन्द्रीय विद्यालय संगठन,  
क्षेत्रीय कार्यालय, एरणाकुलम

KENDRIYA VIDYALAYA SANGATHAN  
REGIONAL OFFICE,  
ERNAKULAM,  
KOCHI – 682 020  
Ph. No,0484- 2205111(DC), 2203091(Fax)  
Website: www.roernakulam.kvs.gov.in  
Email : dcernakulamregion@gmail.com

F.31/Acad/KVS(EKM)

Dated: 11.08.2022

Message

*I feel immense pleasure to publish the study material for class X Artificial Intelligence. This support material is prepared incorporating all the recent changes in curriculum and assessment process made by CBSE. I am sure it will definitely be of great help to class X students of all Kendriya Vidyalayas.*

*Introducing AI as a skill subject and training them appropriately will create the culture of innovation among students. It is important that the next generation upgrade themselves in this developing world and become problem solvers. The 2-day workshop for teachers teaching AI in Class IX and X was to enable them to train the students adequately to meet this purpose. This support material has been prepared as a post workshop activity by a team of dedicated Computer Science teachers and compiled by the resource persons of the workshop.*

*The Support material contains all the important aspects required by the students- the design of question paper, term wise split up syllabus, summary of all the chapters, MCQs, descriptive type and problem-solving questions. I hope that this Support Material will be used by students and teachers as well and will prove to be a good tool for quick revision.*

*I would like to express my sincere gratitude to the In- charge Principal and all the teachers who have relentlessly worked for the preparation of this study material. Their enormous contribution in making this project successful is praiseworthy.*

*Meticulous planning blended with hard work, effective time management and sincerity will help the students to reach the pinnacle of success.*

*Wish you all the best*

( R Senthil Kumar )

*Ms. Hema K*  
Principal /Associate Course Director  
Kendriya Vidyalaya  
NTPC Kayamkulam

## CONTENTS PREPARED BY :

Slno	Teacher Name	Post Held	Name Of Kv
1	Ms. Latha A Ramakrishnan	PGT CS	NO. 2 NAVAL BASE, KOCHI
2	Ms. Reshma Surendran	PGT CS	NO. 2 NAVAL BASE, KOCHI
3	Ms. Anjum Makandar	Computer Instructor	NO. 2 NAVAL BASE, KOCHI
4	Ms. Vrinda S	PGT CS	PORT TRUST, KOCHI
5	Ms. Najiya P M	PGT CS	PORT TRUST, KOCHI
6	Ms. Parvathy G	Computer Instructor	PORT TRUST, KOCHI
7	Mrs. K Vimala Thomas	PGT CS	INS DRONACHARYA, KOCHI
8	Mr. Soju S	PGT CS	INS DRONACHARYA, KOCHI
9	Mrs. Rehna Wilson	Computer Instructor	INS DRONACHARYA, KOCHI
10	Mr. Shabin Muhammed	PGT CS	IDUKKI, PAINAVU
11	Mr. Abhilash V Jose	PGT CS	IDUKKI, PAINAVU
12	Ms. Anju Mathew	PGT CS	RUBBER BOARD KOTTAYAM
13	Ms. Suni Abraham	PGT CS	RUBBER BOARD KOTTAYAM
14	Ms. SINSHA T S	Computer Instructor	NTPC KAYAMKULAM
15	Ms. Sreelekshmi	PGT CS	ADOOR SHIFT - I
16	Ms. Thulasi Balakrishnan	Computer Instructor	ADOOR SHIFT - I
17	Ms. Dhanya T L	Computer Instructor	ADOOR SHIFT - II
18	Ms. Meenu Suresh	Computer Instructor	CHENNEERKARA
19	Ms Aswathy R Nath	Computer Instructor	KONNI
20	Ms. Beena K	Computer Instructor	KOLLAM
21	Mrs. Sheena B R	PGT CS	PALLIPPURAM
22	Mrs. Ambily Krishnan	PGT CS	PALLIPPURAM
23	Mrs. Sharmila Ravindranathan	Computer Instructor	PATTOM SHIFT - I
24	Mrs. Bhagavathi Kumari G	Computer Instructor	PATTOM SHIFT - II
25	Mr. Deepu M.M	Computer Instructor	AFS AKKULAM
26	Mrs. Haripriya Nair	PGT CS	PANGODE
27	Mrs. Santhi P	Computer Instructor	PANGODE
28	Mrs. Aswathy M S	Computer Instructor	SAP CAMP, PEROORKADA

<b>Sno</b>	<b>CONTENTS</b>
<b>1</b>	<b>Syllabus</b>
	<b>PART – A (Employability Skills)</b>
<b>2</b>	<b>Communication Skill</b>
<b>3</b>	<b>Self-Management Skill</b>
<b>4</b>	<b>ICT Skill</b>
<b>5</b>	<b>Entrepreneurial Skill</b>
<b>6</b>	<b>Green Skill</b>
	<b>PART – B (Subject Specific Skills)</b>
<b>7</b>	<b>Introduction to Artificial Intelligence (AI)</b>
<b>8</b>	<b>AI Project Cycle</b>
<b>9</b>	<b>Natural Language Processing</b>
<b>10</b>	<b>Evaluation</b>
	<b>PART - C (Practical Work)</b>
<b>11</b>	<b>Advance Python</b>
<b>12</b>	<b>Data Sciences</b>
<b>13</b>	<b>Computer Vision</b>
<b>14</b>	<b>Practical Programs</b>
<b>15</b>	<b>Sample Question Paper</b>

# CBSE | DEPARTMENT OF SKILL EDUCATION

## CURRICULUM FOR SESSION 2022-2023

---

### ARTIFICIAL INTELLIGENCE (SUB. CODE 417)

#### CLASS – IX & X

#### OBJECTIVES OF THE COURSE:

The objective of this module/curriculum - which combines both Inspire and Acquire modules is to develop a readiness for understanding and appreciating Artificial Intelligence and its application in our lives. This module/curriculum focuses on:

1. Helping learners understand the world of Artificial Intelligence and its applications through games, activities, and multi-sensorial learning to become AI-Ready.
2. Introducing the learners to three domains of AI in an age-appropriate manner.
3. Allowing the learners to construct meaning of AI through interactive participation and engaging hands-on activities.
4. Introducing the learners to AI Project Cycle.
5. Introducing the learners to programming skills - Basic python coding language.

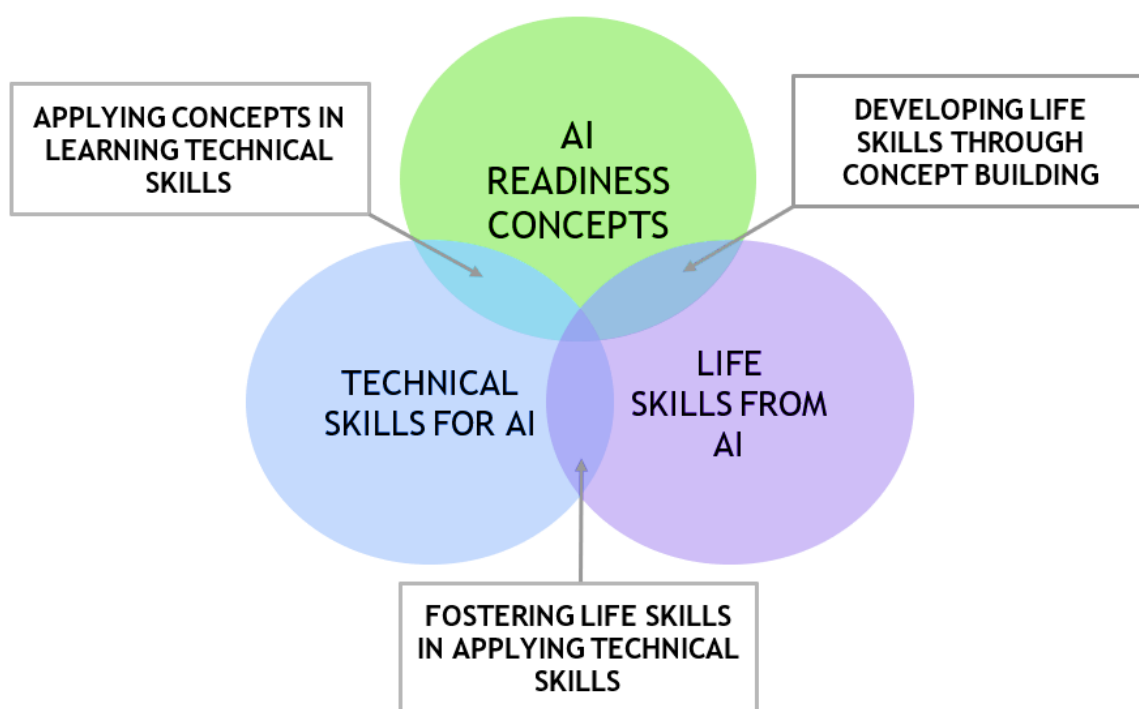
#### LEARNING OUTCOMES:

Learners will be able to

1. Identify and appreciate Artificial Intelligence and describe its applications in daily life.
2. Relate, apply, and reflect on the Human-Machine Interactions to identify and interact with the three domains of AI: Data, Computer Vision, and Natural Language Processing and Undergo assessment for analyzing their progress towards acquired AI-Readiness skills.
3. Imagine, examine, and reflect on the skills required for futuristic job opportunities.
4. Unleash their imagination towards smart homes and build an interactive story around it.
5. Understand the impact of Artificial Intelligence on Sustainable Development Goals to develop responsible citizenship.
6. Research and develop awareness of skills required for jobs of the future.
7. Gain awareness about AI bias and AI access and describe the potential ethical considerations of AI.
8. Develop effective communication and collaborative work skills.
9. Get familiar and motivated towards Artificial Intelligence and Identify the AI Project Cycle framework.
10. Learn problem scoping and ways to set goals for an AI project and understand the iterative nature of problem scoping in the AI project cycle.
11. Brainstorm on the ethical issues involved around the problem selected.

12. Foresee the kind of data required and the kind of analysis to be done, identify data requirements, and find reliable sources to obtain relevant data.
13. Use various types of graphs to visualize acquired data.
14. Understand, create, and implement the concept of Decision Trees.
15. Understand and visualize computer's ability to identify alphabets and handwritings.
16. Understand and appreciate the concept of Neural Network through gamification and learn basic programming skills through gamified platforms.
17. Acquire introductory Python programming skills in a very user-friendly format.

### SKILLS TO BE DEVELOPED:



### SCHEME OF STUDIES:

This course is a planned sequence of instructions consisting of units meant for developing employability and vocational competencies of students of Class IX opting for skill subject along with other education subjects.

The unit-wise distribution of hours and marks for class IX & X is as follows:



# ARTIFICIAL INTELLIGENCE (SUBJECT CODE 417)

## CLASS – X (SESSION 2022-2023)

Total Marks: 100 (Theory-50 + Practical-50)

	<b>UNITS</b>	<b>NO. OF HOURS for Theory and Practical</b>	<b>MAX. MARKS for Theory and Practical</b>
<b>PART A</b>	<b>Employability Skills</b>		
	Unit 1: Communication Skills-II*	10	-
	Unit 2: Self-Management Skills-II	10	3
	Unit 3: ICT Skills-II	10	3
	Unit 4: Entrepreneurial Skills-II	15	4
	Unit 5: Green Skills-II*	05	-
	<b>Total</b>	<b>50</b>	<b>10</b>
<b>PART B</b>	<b>Subject Specific Skills</b>		<b>Marks</b>
	Introduction to Artificial Intelligence (AI)		10
	AI Project Cycle		10
	Natural Language Processing		10
	Evaluation		10
	<b>Total</b>		<b>40</b>
<b>PART C</b>	<b>Practical Work:</b> <ul style="list-style-type: none"><li>• Advance Python</li><li>• Data Science</li><li>• Computer Vision</li></ul>		
	Practical Examination		35
	Viva Voce		
	<b>Total</b>		<b>35</b>
<b>PART D</b>	<b>Project Work / Field Visit / Practical File / Student Portfolio</b>		15
	Viva Voce		
	<b>Total</b>		<b>15</b>
	<b>GRAND TOTAL</b>	<b>200</b>	<b>100</b>

Note: \* marked units are to be assessed through Internal Assessment/ Student Activities.  
They are not to be assessed in Theory Exams

## DETAILED CURRICULUM/TOPICS FOR CLASS X

### Part-A: EMPLOYABILITY SKILLS

S. No.	Units	Duration in Hours
1.	Unit 1: Communication Skills-II	10
2.	Unit 2: Self-management Skills-II	10
3.	Unit 3: Information and Communication Technology Skills-II	10
4.	Unit 4: Entrepreneurial Skills-II	15
5.	Unit 5: Green Skills-II	05
<b>TOTAL</b>		<b>50</b>

**Note:** \* marked units are to be assessed through Internal Assessment/ Student Activities. They are not to be assessed in Theory Exams

The detailed curriculum/ topics to be covered under Part A: Employability Skills can be downloaded from CBSE website.

### Part-B – SUBJECT SPECIFIC SKILLS

**Units to be assessed in theory examinations:**

- ❖ Introduction to Artificial Intelligence (AI)
- ❖ AI Project Cycle
- ❖ Natural Language Processing
- ❖ Evaluation

**Units to be assessed through Practicals:**

- ❖ Advance Python
- ❖ Data Science
- ❖ Computer Vision

### DETAILS OF THE UNITS:

**Units to be assessed in theory examinations:**

UNIT	SUB-UNIT	SESSION / ACTIVITY / PRACTICAL
<b>INTRODUCTION TO AI</b>	Foundational concepts of AI	<b>Session:</b> What is Intelligence?
		<b>Session:</b> Decision Making. <ul style="list-style-type: none"> <li>● How do you make decisions?</li> <li>● Make your choices!</li> </ul>
		<b>Session:</b> what is Artificial Intelligence and what is not?
	Basics of AI: Let's Get Started	<b>Session:</b> Introduction to AI and related terminologies. <ul style="list-style-type: none"> <li>● Introducing AI, ML &amp; DL.</li> <li>● Introduction to AI Domains (Data, CV &amp; NLP)</li> </ul>

UNIT	SUB-UNIT	SESSION / ACTIVITY / PRACTICAL
		<b>Session:</b> Applications of AI – A look at Real-life AI implementations
		<b>Session:</b> AI Ethics
<b>AI PROJECT CYCLE</b>	Introduction	<b>Session:</b> Introduction to AI Project Cycle
	Problem Scoping	<b>Session:</b> Understanding Problem Scoping & Sustainable Development Goals
	Data Acquisition	<b>Session:</b> Simplifying Data Acquisition
	Data Exploration	<b>Session:</b> Visualising Data
	Modelling	<b>Session:</b> Introduction to modelling <ul style="list-style-type: none"> <li>• Introduction to Rule Based &amp; Learning Based AI Approaches</li> <li>• Introduction to Supervised Unsupervised &amp; Reinforcement Learning Models</li> <li>• Neural Networks</li> </ul>
	Evaluation	<b>Session:</b> Evaluating the idea!
<b>NATURAL LANGUAGE PROCESSING</b>	Introduction	<b>Session:</b> Introduction to Natural Language Processing
		<b>Session:</b> NLP Applications
		<b>Session:</b> Revisiting AI Project Cycle
	Chatbots	<b>Activity:</b> Introduction to Chatbots
	Language Differences	<b>Session:</b> Human Language VS Computer Language
Concepts of Natural Language Processing	<b>Hands-on:</b> Text processing <ul style="list-style-type: none"> <li>• Data Processing</li> <li>• Bag of Words</li> <li>• <b>TFIDF (Optional)**</b></li> <li>• NLTK</li> </ul>	
<b>EVALUATION</b>	Introduction	<b>Session:</b> Introduction to Model Evaluation
	Confusion Matrix	<b>Session &amp; Activity:</b> Confusion Matrix
	Evaluation Score Calculation	<b>Session:</b> Understanding Accuracy, Precision, Recall & F1 Score <b>Activity:</b> Practice Evaluation

**\*\*NOTE: Optional components shall not be assessed. They are for extra knowledge**

#### Units to be assessed through Practicals:

UNIT	SUB-UNIT	SESSION / ACTIVITY / PRACTICAL
<b>ADVANCE PYTHON</b> (To be assessed through Practicals)	Recap	<b>Session:</b> Jupyter Notebook
		<b>Session:</b> Introduction to Python
		<b>Session:</b> Python Basics
<b>DATA SCIENCES</b> (To be assessed through Practicals)	Introduction	<b>Session:</b> Introduction to Data Science
		<b>Session:</b> Applications of Data Science

UNIT	SUB-UNIT	SESSION / ACTIVITY / PRACTICAL
		<b>Session:</b> Revisiting AI Project Cycle
	Concepts of Data Sciences	<b>Session:</b> Python for Data Sciences
		<b>Session:</b> Statistical Learning & Data Visualisation
	K-nearest neighbour model <i>(Optional)**</i>	<b>Activity:</b> Personality Prediction <i>(Optional)**</i>
		<b>Session:</b> Understanding K-nearest neighbour model <i>(Optional)**</i>
<b>COMPUTER VISION</b> (To be assessed through Practicals)	Introduction	<b>Session:</b> Introduction to Computer Vision
		<b>Session:</b> Applications of CV
	Concepts of Computer Vision	<b>Session &amp; Activity:</b> Understanding CV Concepts <ul style="list-style-type: none"> <li>• Pixels</li> <li>• How do computers see images?</li> <li>• Image Features</li> </ul>
	OpenCV	<b>Session:</b> Introduction to OpenCV
		<b>Hands-on:</b> Image Processing
	Convolution Operator <i>(Optional)**</i>	<b>Session:</b> Understanding Convolution operator <i>(Optional)**</i>
		<b>Activity:</b> Convolution Operator <i>(Optional)**</i>
	Convolution Neural Network <i>(Optional)**</i>	<b>Session:</b> Introduction to CNN <i>(Optional)**</i>
		<b>Session:</b> Understanding CNN <i>(Optional)**</i> <ul style="list-style-type: none"> <li>• Kernel</li> <li>• Layers of CNN</li> </ul>
		<b>Activity:</b> Testing CNN <i>(Optional)**</i>

\* NOTE: To be assessed through Practicals only and should not be assessed with the Theory Exam.

\*\*NOTE: Optional components shall not be assessed. They are for extra knowledge

## UNIT 1

### Communication Skill:

Part 1: Communication & their types

Part 2: Communication Cycle

Part 3: Feedback in Communication

Part 4: Effective Communication

Part 5: Barriers in Communication

Part 6: Basic Writing Skills

Part 1: Communication & their types

### **Communication**

Communication is **the act of giving, receiving, and sharing information** -- in other words, talking or writing, and listening or reading. Good communicators listen carefully, speak or write clearly, and respect different opinions.

Communication is defined as the imparting or exchanging of information by speaking, writing, or using some other medium

Communication skills allow you to understand and be understood by others. These can include but are not limited to effectively communicating ideas to others, actively listening in conversations, giving, and receiving critical feedback and public speaking.

Communication skills involve listening, speaking, observing, and empathising. It is also helpful to understand the differences in how to communicate through face-to-face interactions, phone conversations, and digital communications like email and social media.

Or

Communication helps people to know each other better. It helps in removing misunderstanding and certain meaning clarity of thought. Communication in any form written, oral, formal informal, visual, interpersonal, intrapersonal help in educating people and connecting them better.

### Types of Communication-:

Communication can be categorized into four basic types:

1. Verbal Communication
2. Non Verbal Communication
3. Visual Communication

## 4. Written Communication

### 1. Verbal Communication-:

Verbal communication is the use of sounds and words to express yourself, especially in contrast to using gestures or mannerisms (non-verbal communication). Example-: Orally communicating.

### 2. Non-verbal Communication-:

Nonverbal communication refers to gestures, facial expressions, tone of voice, eye contact, (or lack thereof), body language, posture, and other ways people can communicate without using language.

### 3. Visual Communication-:

Visual communication is the transmission of information and ideas using symbols and imagery. Types of visual communication include animated GIFs, screenshots, videos, pie charts, infographics, and slide deck presentations. It also includes signs, graphic designs, films, typography, and countless other examples

### 4. Written Communication-:

A 'Written Communication' means the sending of messages, orders or instructions in writing through letters, circulars, manuals, reports, telegrams, office memos, bulletins, etc. It is a formal method of communication and is less flexible.

## Part 2: Communication Cycle

### **Communication Cycle**

Communication is one of the most vital elements of society. People need people, and to interact, it's essential they be able to convey messages and understand each other. The communication cycle expresses how the system of conveying and understanding messages operates.

**Sender:** the person or entity originating the communication.

**Message:** the information that the sender wishes to convey.

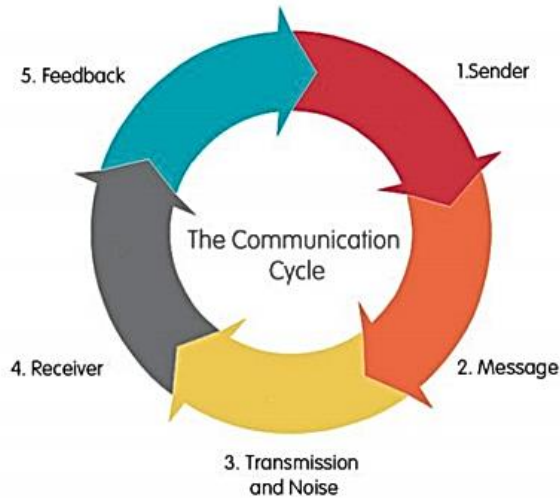
**Encoding:** how the sender chooses to bring the message into a form appropriate for sending.

**Channel:** the means by which the message is sent.

**Receiver:** the person or entity to whom the message is sent.

**Decoding:** how the receiver interprets and understands the message.

**Feedback:** the receiver's response to the message.



In the communication process, one person is a sender who convey message to another person or a group of persons) nose as the receiver. When the receiver gets the message, he acknowledges it and sends back a response. This leads to a cycle process known as the communication cycle. The cycle describe how can ideas, impression, or feeling is made no to others full stopper communication cycle includes resource such as e-mail threads social media outlets, VoIP message outlets. In the communication process, one person is a sender who convey message to another person (or a group of persons) nose as the receiver. When the receiver gets the message, he acknowledges it and sends back a response. This leads to a cycle process known as the communication cycle.

### **Part 3: Feedback in Communication**

#### **Feedback in Communication**

The term '**feedback**' is taken from cybernetics, a branch of engineering concerned with self-regulating systems.

**The observation of the receiver's response** is called feedback. In other words, the part of the receiver's response communicated back to the sender is called feedback. Actually it is the amount of response of the receiver that reaches to the sender. It enables the sender to evaluate the effectiveness of the message.

In the communication process, feedback refers to a response from the receiver which gives the communicator an idea of how the message is being received and whether it needs to be modified.

Feedback ensures that the message has been successfully conveyed and the communication is effectively successful.

Feedback is important in communication because it enables the sender to evaluate the effectiveness of its message. Without feedback, the communication process would be incomplete.

### Importance of feedback in communication:-

1. It completes the whole process of communication and makes it continuous.
2. It sustains communication process.
3. It makes one know if one is really communicating or making sense.
4. It is a basis for measuring the effectiveness of communication.
5. It is a good basis for planning on what next to be done especially statistical report.
6. Communication will be useless without feedback.
7. Feedback paves way for new idea generation.
8. It is a process of effective listening.
9. It serves as basis of problem-solving.
10. Can motivate.
11. It can improve performance.

“To be effective, feedback needs to be clear, purposeful, meaningful, and compatible with students' prior knowledge and to provide logical connections” (Hattie & Timperley, 2007, p. 104). Task specific – feedback requires learning context and therefore needs to be task specific.

### **In order to be effective, feedback must be:**

- Specific. Feedback must be concrete and relate to a specific, measurable performance goal.
- Timely
- Appropriate
- Focus on behaviour, not personality
- Proactive
- Given using descriptive language
- Not given using judgmental language
- Based on accurate and credible information.

### Types of Feedback:-

Feedback can be various form and of various types. Let us discuss different types of feedback used in communication.

1. Formal and informal feedback
2. Descriptive and non-descriptive feedback
3. Specific and nonspecific feedback

### Formal and informal feedback

#### Formal Feedback:-

A formal feedback follows a present format or structure using which the receiver provides feedback and sends it. Formal feedback covers many predefined points and has a specific blueprint. The receiver provides the feedback as per this blueprint and sends it. Formal feedback takes time to construct and hence, is not instant.



## Examples:

“Congratulations on scoring with A Grade in your final test performance. You are promoted to your next class.”

“Please accept my apologies.”

### Informal Feedback-:

Informal feedback, on the other hand, is spontaneously friendly and does not stick to a specific structure such as instant comments by the listener or audience. It does not take time to construct as it is immediately conveyed.

### Examples:

“Good job! “, “Congratulations!” “Sorry”

## 2. Descriptive and non-descriptive feedback-:

### Descriptive feedback:

A descriptive feedback on the contrary, provides meaningful information in a detailed, expressive manner that also contains some analysis or suggestion etc.

### Examples

“All paragraphs should cover basically on Idea. Only one paragraph was as per this specification, other paragraphs convey multiple ideas and the information was also cohesively linked.”

“In your article, the conclusion did not reiterate your observation and did not support the evidence your article talks about. You need to rewrite the conclusion by keeping this thing in mind.”

### Non-descriptive feedback-:

A non-descriptive feedback provides some specific information but does not give details descriptions. The feedback conveys meaningful specific response but does not come with descriptive analysis or suggestions.

### Examples

“I only like your second paragraph. Others needs improvement.”

“In your article, conclusion needs rework”

## 3. Specific and Non-specific Feedback:

### Specific Feedback-:

The specific feedback talks about a thing, particularly without talking about a General overview.

### Example-:

“I like the way you described your grandfather's character. It makes me feel like I too know him”.

“I like your portrayal of sibling rivalry, especially the part where you and your sister were fighting. I fight with my brother too, so it made it sound real to me. your story seemed related at all points.”

### Non-specific Feedback-:

The Non-specific feedback, on the other hand, talks about the entire think while giving a General overview. it does not particularly pinpoint is specific think/ feature.

### Examples:

“I like your story. It is good.”

“I like it your topic of sibling rivalry.”

.....

### CHECK POINT :

**Q1. Which of the following is NOT an element of communication within the communication process cycle?**

- A) Channel
- B) Receiver
- C) Sender
- D) Time**

**Q2. You need to apply for leave at work? Which method of communication will you use?**

- A) e-mail**
- B) Poster
- C) Newsletter
- D) Blog

**Q3 Which of the following is an example of oral communication?**

- A) Newspapers
- B) Letters
- C) Phone call**
- D) E-mail

**Q4 Which of these are examples of negative feedback?**

- A) I hate to tell you this but your drawing skill is poor.**
- B) You can surely improve your drawing

C) These are good drawings but you can do better.

D) None of the above

**Q5. What are the types of words we should use for verbal communication?**

A) Acronyms

**B) Simple**

C) Technical

D) Jargons

**Q6. Which of the following is an effective components of good feedback?**

A) Detailed and time consuming

B) Indirect

**C) Specific**

D) Opinion-based

**Q 7 Which of these are examples of positive feedback?**

A) Excellent, your work has improved

B) I noticed your dedication towards the project.

C) You are always doing it the wrong way.

**D) All of the above**

**Q8 Which of the following statement is true about communication?**

A) 50% of our communication is non-verbal

B) 20% communication is done using body movements, face, arms, etc

C) 5% communication is done using voice, tone, pauses, etc.

**D) 7% communication is done using words**

**Q9 Which of these is NOT an appropriate non-verbal communication at work?**

**A) Keeping hands in pockets while talking**

B) Talking at moderate speed

C) Sitting straight

D) Tilting head a bit to listen

**Q10 Which of these is a positive (good) facial expression?**

A) Frowning while concentrating

**B) Maintaining eye contact**

C) Smiling continuously

D) Rolling up your eyes

## Part 4: Effective Communication

### **EFFECTIVE COMMUNICATION**

#### **Introduction:**

Effective communication is a two way communication process where both parties have right and convenience to express their messages opinions, facts and other informations.

#### **Principles of Effective Communication:**

- **Clarity:-**

Message conveyed should be in easily understandable language.

- **Attention:-**

The receiver should be fully attentive in a communication process.

- **Consistency:-**

This principle implies that communication should always be consistent with the planned objective of message being conveyed

- **Adequacy:-**

The information conveyed should be complete in all respects.

- **Timelines:-**

The message conveyed should be at the proper time.

- **Feedback:-**

The communication must have feedback confirmation from the recipient whether the messages have been understood by the recipient

- **Economy:-**

The communication should take place in a way that costs optimally.

### **7Cs of Effective Communication**

- **Clear:** While communicating one should be clear about what he / she say.
- **Concise:** Use simple words and say only what is needed.
- **Concrete:** Your arguments should be based on solid facts and opinions from credible sources and you should share reliable data to support your stand.
- **Correct:** It's essential that along with the factual information, the language and grammar you use are correct.
- **Coherent:** Your words should make sense .Along with that it should related with the main topic
- **Complete:** Your message should be complete .It should have all the needed information
- **Courteous:** Be respectful , honest and friendly throughout your communication

## Part 5: Barriers in Communication

### Barriers in communication

- Linguistic Barrier: Language at times can be a barrier to effective communication
- Physical Barrier: If the surroundings do not support proper communication, it can also act as a barrier to appropriate interaction.
- Cultural Barrier: Cultural differences hinder us from communicating properly.
- Interpersonal Barriers: It refers to the situations when the intended message is received incorrectly due to many personal reasons.
- Organizational Barriers: In an organization if there is no clarity about the roles, structures, responsibilities, it will hinder effective communication among the members of the organization.

### Measures to Overcome Barriers of communication

- Overcoming Lingual Factors: To overcome this one need to prepare appropriately. One should carefully think about the language needs of the recipient.
- Overcoming Environmental Factors: Communicators should ensure that the message is delivered in a distraction free environment.
- Overcoming Barrier of Cultural Influence: Preparation to be made keeping the culture of the people you are addressing.
- Overcoming Interpersonal Barriers of Communication:
- Overcoming Organizational Barriers of Communication

## Part 6: Basic Writing Skills

### **WRITING SKILLS**

Writing skills are an important part of communication. Good writing skills allow you to communicate your message with clarity and ease to a far larger audience than through face-to-face or telephone conversations.



### Parts of speech:

- Noun: A noun is the name of a person, place, thing, or idea.
- Pronoun: A pronoun is used in place of a noun or noun phrase to avoid repetition.
- Verb: A verb shows an action or state of being. A verb shows what someone or something is doing.

- Adjective: An adjective describes, modifies, or gives more information about a noun or pronoun.
- Article: A word that introduces a noun.
- Adverb: An adverb describes/modifies a verb, an adjective, or another adverb. It tells how, where, when, how often or to what extent.
- Preposition: A preposition shows the relationship of a noun or pronoun to another word. They can indicate time, place, or relationship.
- Conjunction: A conjunction joins two words, ideas, phrases, or clauses together in a sentence and shows how they are connected.
- Interjection: An interjection is a word or phrase that expresses a strong feeling or emotion. It is a short exclamation.

### **Capitalisation and Punctuation:**

These are important while writing sentences as they help readers understand and interpret the message.

<p><b>1. Capitalize the first word of every sentence, and every new line.</b></p> <ul style="list-style-type: none"> <li>• I got up early. Then I went to school.</li> </ul>	<p><b>2. Capitalize the first word of quoted sentences.</b></p> <ul style="list-style-type: none"> <li>• He said to her, "You betray my trust!"</li> </ul>
<p><b>3. Capitalize the names of people</b></p> <ul style="list-style-type: none"> <li>• Mary, John, Sam, Susan, etc. </li> </ul>	<p><b>5. Capitalize the name of streets, cities, provinces, states &amp; countries</b></p> <ul style="list-style-type: none"> <li>• Washington street, the United States</li> </ul>
<p><b>6. Capitalize the place or specific locations.</b></p> <ul style="list-style-type: none"> <li>• I love studying English and history.</li> </ul>	<p><b>4. Capitalize words derived from proper nouns.</b></p> <ul style="list-style-type: none"> <li>• I am headed to the South this summer.</li> </ul>
<p><b>7. Capitalize the names of books, movies, arts, articles, etc.)</b></p> <ul style="list-style-type: none"> <li>• One Hundred Years of Solitude</li> <li>• The Return of Superman</li> </ul>	<p><b>8. Capitalize the pronoun "I"</b></p> <ul style="list-style-type: none"> <li>• My friend and I go to school together.</li> </ul>
<p><b>9. Capitalize an interjection, an exclamation</b></p> <ul style="list-style-type: none"> <li>• Oh! Look! Surprise! Woah!</li> </ul>	<p><b>10. Capitalize opening and closing of a letter</b></p> <ul style="list-style-type: none"> <li>• Dear Mary,</li> <li>• Cheers, Sincerely, etc. </li> </ul>

PUNCTUATIONS CHAT		
Names	Purpose	Example
● Full Stop	End a sentences	My brother is in army.
, Comma	Separate items in a list	He was a wise, clever and old man.
? Question Mark	Ask a question	How are you?
() Brackets	Set of less important details	The two boy (Ali and Umer) are absent.
- Hyphen	Join words together	My eight-year son love me.
' Apostrophe	Show ownership	Your t's and S's ar incorrect.
! Exclamation Mark	Emphasis a strong feelings	How shamefull!
; Semi-Colum	Link elements of sentences	To err is human; to forgive is divine.
: Colon	Introduce a list	It is said: Pride hath a fall,
... Ellipsis	Show that's parts of sentences are let out	To be continue .....
— Dash	Sum up several things or facts	Health, wealth, fame – every thing she had

## Sentences:

A group of words that makes complete sense is called a sentence. The sentence must contain the subject and a predicate.

## Kinds of Sentences:

There are four kinds of sentences:

1. Assertive or declarative sentence or Statement
2. Integrative sentence (a Question)
3. Imperative sentence (a Command)
4. Exclamatory sentence (an Exclamation)

## Parts of a sentence-:

Every complete sentence contains two parts---

1. Subject
2. Predicate.

### • Subject-:

A subject is a word or group up of words which conveys the name of the person or think that we are asking about.


### • Predicate-:

On the other hand, It is the part of the sentence which contains a verb, and state something about the subject.



## Active and Passive voice

The object of the active sentence becomes the subject of the verb in the passive voice.

<h1>Active Voice</h1>	<h1>Passive Voice</h1>
<p>Active voice is a grammar term used to classify sentences in which the subject of the sentence is the one actively performing the action of the verb</p>	<p>A verb is in the passive voice when the subject of the sentence is acted on by the verb</p>
<h3>Examples</h3> <ul style="list-style-type: none"><li><input type="checkbox"/> He helped me.</li><li><input type="checkbox"/> Mr. John teaches poor people.</li><li><input type="checkbox"/> Let us throw the ball far away.</li><li><input type="checkbox"/> They ate the food in the Morning.</li><li><input type="checkbox"/> the Nurse was examining him.</li><li><input type="checkbox"/> the Headmaster is teaching the class.</li><li><input type="checkbox"/> They will have finished their work by twelve.</li><li><input type="checkbox"/> How can they give up the struggle</li><li><input type="checkbox"/> I saw them at the police station yesterday.</li><li><input type="checkbox"/> we shall play a Hockey match tomorrow.</li><li><input type="checkbox"/> he was planting new trees in the home garden.</li></ul> 	<h3>Examples</h3> <ul style="list-style-type: none"><li><input type="checkbox"/> I was helped by His.</li><li><input type="checkbox"/> Poor people are taught by Mr. John.</li><li><input type="checkbox"/> Let the ball be thrown by us far away.</li><li><input type="checkbox"/> The food was eaten by them in the Morning.</li><li><input type="checkbox"/> He was being examined by the Nurse.</li><li><input type="checkbox"/> The class is being taught by the Headmaster.</li><li><input type="checkbox"/> Their work will have been finished them by Twelve</li><li><input type="checkbox"/> How can the struggle be given up by them.</li><li><input type="checkbox"/> they were seen at the police station by me yesterday.</li><li><input type="checkbox"/> A hockey match will be played by us tomorrow.</li><li><input type="checkbox"/> New trees were being planted by him in the home garden</li></ul>

## UNIT 2 :

### SELF- MANAGEMENT SKILLS

#### Self-Management Skills

**Def:-** Self-management, which is also referred to as 'self-control' or 'self-regulation', is the ability to regulate one's emotions, thoughts, and behavior effectively in different situations. This includes motivating oneself, and setting and working towards personal and academic goals.

#### Domains of Self-Management Skills

- i. Stress Management
- ii. Self-Awareness
- iii. Self-Motivation
- iv. Set Goals
- v. Time Management

### Self-Management Skills and Tips

#### Stress management

- exercise your body;
- enjoy yourself, rest yourself as regularly as possible;
- go to vacations and holidays with the people you love;
- take walks in nature;
- do hobbies.



#### Self confidence

- get rid of the negative thoughts in your head;
- think positively;
- be happy with small things;
- do not forget to tell yourself that you are smart and intelligent;
- chat with positive people;

#### Self-motivation

- find and list your motives (needs and desires);
- find different sources of motivation and inspiration (music, books, activities);
- think expansive thoughts;
- live fully in the present moment;
- dear to have big dreams;
- dream often – every day;
- remember that nothing is impossible.



#### Time management and organization skills

- set and prioritize your goals
- create a schedule;
- make lists of tasks;
- use different optimization tools
- break large tasks into smaller tasks.



#### Have a healthy lifestyle and a balanced diet

Healthy eating and physical activities are extremely important when it comes to increasing your mind and body power



[www.businessphrases.net](http://www.businessphrases.net)

#### Stress management: -

Managing stress is all about taking charge: taking charge of your thoughts, your emotions, your schedule, your environment, and the way you deal with problems. The ultimate goal is a balanced life, with time for work, relationships, relaxation, and fun – plus the resilience to hold up under pressure and meet challenges head on.

#### Stress: -

- Stress is a normal physical response to events that make you feel threatened or upset your balance in some way.
  - When you sense danger – whether it's real or imagined – the body's defences kick into high gear in a rapid, automatic process known as the —"fight-or-flight" reaction, or the stress response.
- There can be two types of stress- **good stress** and **bad stress**.

### **Good Stress:**

- Good stress helps us go about our daily tasks and achieve those hard-to-reach goals.
- This stress, called eustress, helps us learn new things, adapt to change and engage in creative thinking.
- Everyone experiences good stress on a daily basis.
- Another form of good stress is the stress that enables us to survive in times of trauma.
- This stress makes us aware of danger and enables us to escape when we need to.

### **Bad Stress:**

- Bad forms of stress do not help us achieve goals or tasks, but instead actually inhibit our ability to function on a daily basis.
- Bad stress occurs when too much stress builds up around us.
- Once the body feels there is too much stress, it will begin to break down, causing symptoms like perspiration, anxiety, headaches and rapid breathing.
- This kind of stress can take a huge toll on your physical and mental well-being.

### **Benefits / Importance / Needs of Stress Management**

Here are the benefits that can be derived with practicing an efficient stress management method:

- It improves your overall health status.
- You are able to assume a more positive attitude and outlook in life.
- It increases your productivity since you are able to focus clearly on your tasks.
- You have better control over your emotions and how you respond to it.
- And more importantly, you reduce or eliminate stress in your life.
- Improving mood.
- Boosting immune system.
- Improve thinking ability.

### **STRESS MANAGEMENT TECHNIQUES**

Stress Management techniques help to guide and empower individuals to maintain equilibrium, stabilise their emotions, and live a productive life.

1. Keep a positive attitude.
2. Accept that there are events that you cannot control.
3. Be assertive instead of aggressive. Assert your feelings, opinions, or beliefs instead of becoming angry, defensive, or passive.
4. Learn and practice relaxation techniques; try meditation, yoga, or tai-chi for stress management.
5. Exercise regularly. Your body can fight stress better when it is fit.
6. Eat healthy, well-balanced meals.
7. Learn to manage your time more effectively.
8. Set limits appropriately and learn to say no to requests that would create excessive stress in your life.

9. Make time for hobbies, interests, and relaxation.
10. Get enough rest and sleep. Your body needs time to recover from stressful events.
11. Seek out social support. Spend enough time with those you enjoy.
12. Seek treatment with a psychologist or other mental health professional trained in stress management or biofeedback techniques to learn healthy ways of dealing with the stress in your life.

### **Independent Working: -**

Independent or self-directed learning is an important skill, whether you plan to continue your studies after school or college or professionally.

Independent learning is when an individual is able to think, act and pursue their own studies autonomously, without the same levels of support you receive from a teacher at school.

### **To become a good independent learner you need to be:**

- Motivated
- Resilient, to overcome challenges
- An excellent time manager
- Becoming self-aware, self-monitoring and self-correcting;
- Knowing what you need to do;
- Taking the initiative rather than waiting to be told what to do;
- Doing what is asked to the best of your ability, without the need for external prodding, and working until the job is completed;
- Learning to work at a pace that you can sustain;
- Taking ownership of your mistakes without looking for excuses; and
- Refusing to let self-doubt or negative emotions due to negative past experiences take you off course.

### **Advantages & Disadvantages of Working Independently**

#### **Advantages of Working Independently: -**

- There's Less Conflict
- You're More Efficient
- You Can Enjoy a Challenge
- You're in Charge
- You Take Full Credit

#### **Disadvantages of Working Independently: -**

- There's Less Teamwork
- There's Less Creativity
- You'll Be More Stressed
- You'll Get Bored
- You Take Full Responsibility

#### **Characteristics for Independent Working / Self Reliant**

- Self-awareness
- Self-motivation
- Self-regulation

## **Self-Awareness: -**

- ✓ Self-awareness means searching for patterns in the manner we think about what is taking place, how we can explain matters to ourselves, and also make sense of the surroundings.
- ✓ Self-awareness implies comprehending our moods as well as emotions. Rather than attempting to avoid how we are feeling, we perceive and even become interested in our feelings, including the uncomfortable and tough ones.
- ✓ Self-awareness implies focusing on how we are prone to behave and act in some particular circumstances. How are we going to respond to certain things? What exactly are our tendencies and habits?

### **Some useful questions to think about in this regard are the following:**

- What kind of science do you enjoy doing? Fundamental or applied?
- Do you enjoy working in the lab or in an office?
- Do you enjoy explaining your work? How? Orally? In Writing? Both?
- Do you like working with others as a member of a team or do you prefer to work by yourself?
- Are you a good listener?
- Can you handle personal conflict?
- Do you prefer delving into a problem deeply?
- Do you see the "big picture"?
- Do you prefer to work on short term projects (6 months or less) or long term projects?
- Do you enjoy using instrumentation? What kinds?
- Do you enjoy using computers and/or software?
- Do you enjoy travel? Can you speak one or more foreign languages conversationally?
- Can you read in another language?
- Are you self-motivated? Do you require external prompts in order to meet deadlines and/or achieve results?

## **Types of Self awareness**

1. Internal Self awareness
2. External Self awareness

### **Internal Self awareness**

- Internal Self-awareness is about focusing on your inner values.
- The emotions, values, goals, aspirations, everything which we possess in our inner feelings.
- Behaviours, thoughts, our weaknesses, and strength which help us present our views and feel in a certain way. These things come under the category of internal Self-awareness.
- Any self-aware person can introspect the inner values. This makes them aware of their behaviours and emotions. One can even manage their feelings and control

them if they are aware of what bothers them. Be it any good or bad actions taken by them that can recognize it very quickly.

### External Self awareness

- External Self-awareness deals with our feelings and behaviour with others.
- It's the ability to look at others.
- When we assume about a leader, she/he should be empathetic towards their employees. It helps to build a healthy relationship.
- This awareness helps you decide what others think about you.
- If you can judge whether a person is happy with you or not, then you have better external Self-awareness. It certainly makes a person more effective in paying attention to others.

### Self-Motivation: -

- Self-motivation is ability to do things on your own without being told to do so.
- Self-motivation is a glorious cycle of boosting self-confidence and self-esteem.
- Self-motivation definition, initiative to undertake or continue a task or activity without another's prodding or supervision.

### Self-regulation: -

Self-regulation is the ability to understand and manage your behaviour and your reactions to feelings and things happening around you.

### Multiple Choice Questions:

**Q1. Stress is identified as a condition in which a person is .....**

- A) tensed
- B) worried
- C) relaxed
- D) both (A) and (B)

**Q2. What plays a major role in reaction to stress**

- A) Emotions
- B) Personality
- C) Confidence
- D) None of these

**Q3. The feeling of self-awareness enhances our.....**

- A) Self-confidence
- B) Self-monitoring
- C) Self-Regulation
- D) All of the above

**Q4. The internal stress caused by .....**

- A) pent-up worries
- B) laziness
- C) survival stress
- D) experiences

**Q5. Physical exercise is used as a stress management technique because**

- A) It improves blood circulation
- B) improves self-image
- C) make us feel better
- D) All of the above

**Q6. Stress management prevents \_\_\_\_\_**

- A) psychological disorders
- B) behavioural problems
- C) both of the above
- D) none of the above

**Q7. Self-Reliance means \_\_\_\_\_**

- A) Ability to Work Independently
- B) Complete the task effectively
- C) Both of the above
- D) None of the above

**Q8. .... is not a symptom of stress?**

- A) Increased sweating
- B) Cold hands or feet
- C) Dry mouth
- D) None of these

**Q9. Which of the following is not a kind of self-awareness?**

- A) Knowing your weaknesses
- B) Knowing your relatives
- C) Knowing your flaws
- D) Knowing your strengths

**Q10. Which of the following focuses on your ability to influence personal and professional improvement based on your self-awareness and motivation?**

- A) Self-regulation
- B) Self-awareness
- C) Self-motivation
- D) All of these

**Answers:**

**Q1.D)            Q2.B)            Q3.A)            Q4.A)            Q5.D)            6.C)    Q7.C)**  
**Q8.D)            Q9.B)            Q10.A)**

**Answer the following questions(2 Marks)**

1. What do you mean by Self-management?

Ans. Self-management, also referred to as 'self-control,' is the ability to control one's emotions, thoughts, and behaviour effectively in different situations.

2. Give any two examples where small amount of stress is helpful.

Ans. Two examples where small amount of stress is helpful are:

- a. A fire alarm is intended to cause stress that alerts you to avoid danger.
- b. The stress created by a deadline to finish a paper can motivate you to finish it on time.

3. Write the effects of stress on our life.

Ans. It can harm our emotional and physical health, and limit our ability to function well at home, in school and within our relationships.

**Answer the following questions(3Marks)**

1. What is Stress?

Ans – Our emotional, mental, physical, and social responses to perceived demands or threats are referred to as stress. Stressors are the pressures or threats that people face.

For example –

- a. You're only a few days away from your examinations, yet you're feeling unprepared.
- b. you are experiencing a loss of someone close in the family.
- c. You're concerned about what others will think of you if you don't dress properly or speak confidently.
- d. you are stressed due to lack of sleep.

2.How can you identify your Strengths and Weaknesses?

Ans-The techniques for identifying our strengths and weaknesses are –

Finding Strengths

- Think of anything that you are always successful at.
- Think about what others like in you.
- Take out time and think about what you do well

Finding Weaknesses

- Point out the areas where you struggle and the things you find difficult to do.
- Look at the feedback others usually give you.
- Be open to feedback and accept your weaknesses without feeling low about it.

3.Explain the importance of Stress Management.

Ans:- Stress management is important as:

- ➔ It allows a person to react positively in stressful situations.
- ➔ It provides ways to measure the different levels of stress so that the inflicted person can resort to self-help or seek help from a professional.
- ➔ It helps to identify distinct stressors, which can either be good or bad. They can be self-induced or be triggered due to external situations. They can be categorised as: Positive stressors, Dangerous stressors (leads to stressful situations), irrelevant stressors.



## UNIT 3

### ICT SKILLS

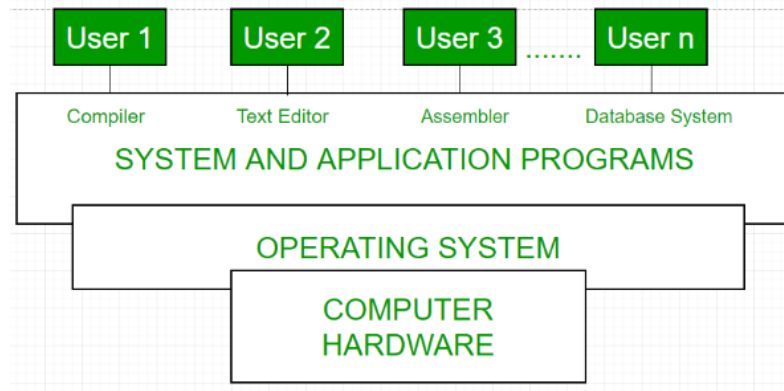
#### TYPES OF OPERATING SYSTEMS

**An Operating System (OS)** is an interface between a computer user and computer hardware. An operating system is a software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers. Some popular operating systems are,

- **DOS** (Disk Operating System) • **Windows** It is an operating system developed by Microsoft.
- **Linux** It is an operating system designed for personal computers. It is a free and open-source software
- **Mobile operating Systems**
  - ✓ Android
  - ✓ Symbian
  - ✓ Windows Phone
  - ✓ iOS

Following are some of important functions of an operating System.

- Memory Management
- Processor Management
- Device Management
- File Management
- Security
- Control over system performance
- Job accounting
- Error detecting aids
- Coordination between other software and users



The different types of operating systems are as follows:

**Interactive (GUI-based)** A graphical user interface is a user-friendly operating system in which commands can be entered by clicking/double-clicking/right-clicking a mouse. Windows operating system is an example of an interactive operating system.

**Single-user, single-task operating system:** This type of operating system allows only one user to do a task on the computer and one thing at a time.

**Single-user, multi-task operating system:** This type of operating system is used on Desktop computers, laptops, where a single user can operate on several programs at the same time. For example, Windows, Apple MacOS are examples of single-user multi task operating system.

**Multi-user** A multi-user operating system enables multiple users to work on the same computer at different times or simultaneously.

**Real Time** A real time operating system is used to control machinery, scientific instruments, like robots, in complex animations and computer controlled automated machines. A real-time operating system is a computing environment that reacts to input within a specific period of time. It manages the resources of the computer so that any particular operation is executed in the same amount of time every time it is executed. Windows CE and Lynx OS are examples of real-time operating systems.

**Distributed** A distributed operating system runs on a set of computers that are interconnected by a network. It combines the different computers in the network into a single integrated computer and storage location. Windows, UNIX, and LINUX are examples of distributed operating systems.

### Windows 7 operating system

Windows 7 is an operating system developed by Microsoft and is used on personal computers.

After loading Windows 7, the first screen that appears on the monitor is called **desktop**. From the desktop, you can access different components of Windows 7.

By default, Windows 7 has a picture for the desktop background. This is called **wallpaper**.

Small pictures on the desktop are called **icons**. These icons represent files, folders,

applications, etc. At the bottom of the desktop is a long bar called the Taskbar. To the left of the taskbar is the Start button.

### Components of Windows 7 Desktop

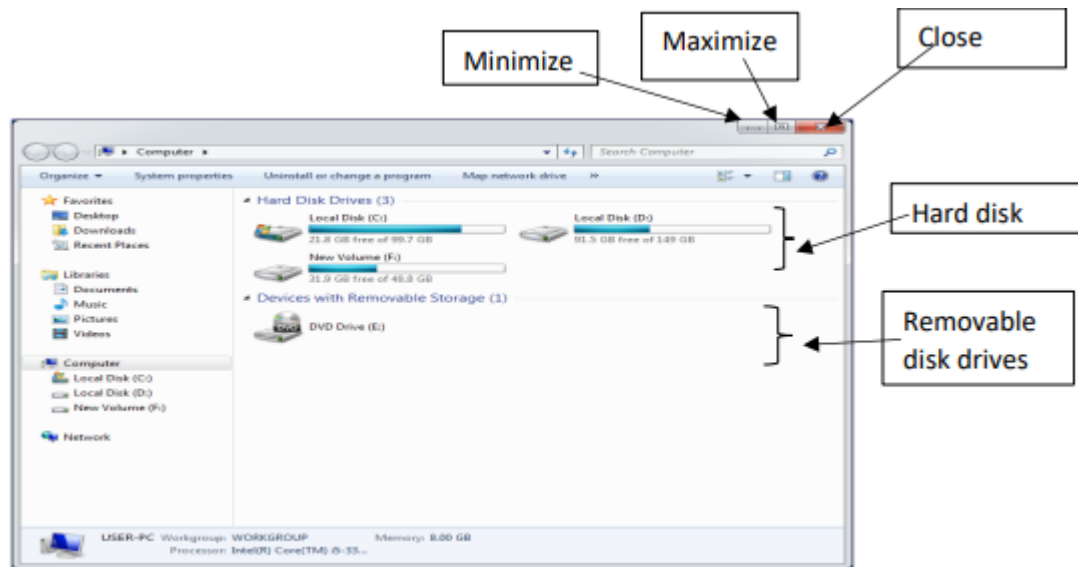
The components of Windows 7 Desktop are shown in **figure 1**.



Figure 1

## Computer :

It displays all the storage areas of the computer . Through the **Computer icon**, you can access all drives, files, and folders on the computer. When you double-click Computer icon, a window shown below in **Figure 2** appears on the screen.

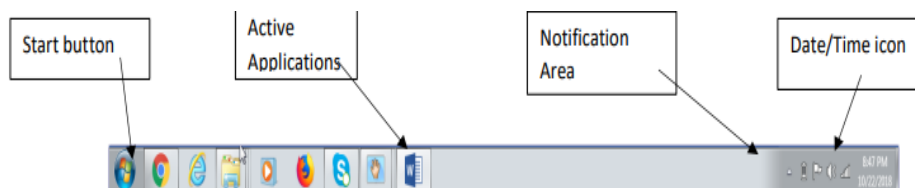


**Fig 2 Computer Window**

## Taskbar

Taskbar is the long horizontal bar present at the bottom of the screen. To left of the Taskbar is the **Start** button and to the right appears **Date/Time**. You can also see icons of active applications and some shortcuts on the Taskbar

The main components of Taskbar are shown in the following **figure 3**:



**Fig 3 Taskbar**

**Start button** it is located on the left of the taskbar. Clicking the Start button (**Figure 4**) opens the Start menu and provides access to programs and features, like:

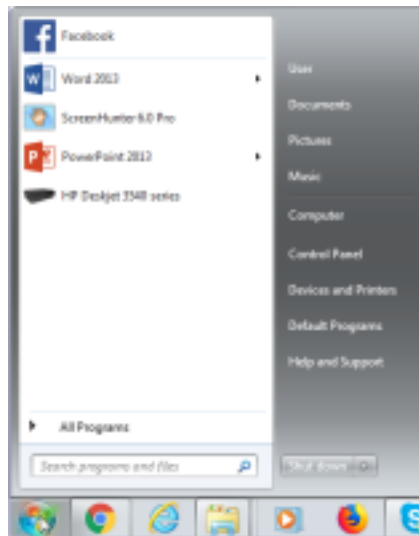
**Shut Down:** - allows the user to turn off the computer

**All Programs:** - Provides access to all the installed programs and applications. To start an application, just click it.

**Search Box:** - This allows the user to search a file or a folder or run executable files. **Control**

**panel:** - This allows the user to change various settings.

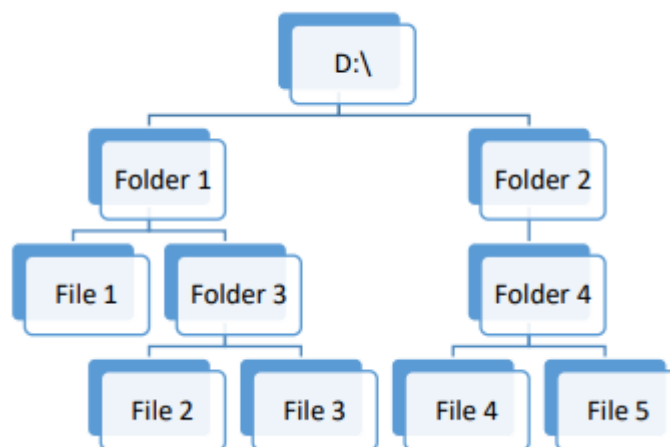
**Recycle Bin** Files and folders deleted by the user are stored in the Recycle Bin. From Recycle Bin, you can retrieve files or folders deleted by mistake.



**Fig 4 Start button**

## **File Concept, File Operations, File Organization, Directory Structures And File-System Structures**

Everything you store on your computer is stored in the form of a file. There are specific naming conventions for naming files or folders, like characters that can be used, maximum number of characters, etc. Files can be separately placed into groups, called folders/directories. Each directory/folder can contain related files and/or sub-folders



**The steps to create a new folder are:**

1. Double-click the Computer icon.
2. Select the drive in which you want to create a new folder. Say, Local Disk D:.

3. Window will open up showing files and folders in Local Disc D: Click New Folder on the toolbar.
4. A new folder is created with name New Folder highlighted
5. Type a name for the folder

**To create a new file:**

1. Right-click anywhere in the blank area of the right-column.
2. In the Shortcut menu, click New and select the type of the file you want to create.

**To rename a file or a folder:**

1. Right-click the file or the folder.
2. From the shortcut menu, select Rename option
3. Type the new name or edit the existing name and press the Enter key.

Or Just select the file/folder and press Function key F2.

**To copy a folder or directory**

You can copy a file or a folder in any one of the following ways:

**1. Shortcut menu:**

- a. Right-click the file or the folder you want to copy.
- b. Select Copy option from the Shortcut menu.
- c. Select the drive or the folder where you want to make a copy of the selected file or folder.
- d. Right-click and select Paste option from the Shortcut menu.

**2. Drag and Drop method:**

To copy a file or a folder, hold down the Ctrl key while dragging it to the new location.

**3. Using Keyboard:**

- a. Select the file or the folder.
- b. Press Ctrl + C to copy the file or the folder.
- c. Open the destination folder.
- d. Press Ctrl + V to paste the copied file.

**To Move Files and folders**

You can move a file or a folder in any one of the following ways:

**1. Shortcut menu:**

- a. Right-click the file or the folder you want to copy.

- b. Select Cut option from the Shortcut menu.
  - c. Select the drive or the folder where you want to move the selected file or folder.
  - d. Right-click and select Paste option from the Shortcut menu.
2. Drag and Drop method: To copy a file or a folder, select the file and drag it to a new location.
3. Using Keyboard:
- a. Select the file or the folder.
  - b. Press Ctrl + X to cut the file or the folder.
  - c. Open the destination folder.
  - d. Press Ctrl + V to paste the copied file.

### **To permanently delete Files**

You can permanently delete the contents of the Recycle Bin in any one of the following ways:

Right-click the Recycle Bin icon and then click Empty Recycle Bin

OR

1. Double-click the Recycle Bin icon.
2. The Recycle Bin window appears.
3. Click Empty the Recycle Bin.

### **To restore the files and folders**

To recover a file from the Recycle Bin, right-click the file, and then click Restore.

Or

Select the file and click Restore this item

## **CARE AND MAINTENANCE OF COMPUTER**

### **Regular maintenance of the computer system is very important.**

Some of the maintenance activities are:

- Keep the components of the computer, like keyboard, mouse, monitor, etc. clean.
- Replace hardware that is not functioning properly
- Keep food items away from the computer
- Cables and chords should not be messed up
- Removing unauthorized software from the computer
- Take regular backup of the data
- Ensure backups are working properly by periodically restoring or checking of data. You should

use external hard drive for backup of data on your computer.

- Run anti-virus periodically
- Keep anti-virus software up to date
- Do not overcharge the batteries
- Do not block the vents
- Always shut down the computer properly

How to take

### **Measures to protect Computer**

Regular scans should be done to check for viruses, malware, etc.

An effective antivirus software should be installed in your computer.

Always keep your anti-virus software updated so that it can detect new viruses. Full system scan should be done to periodically, preferably weekly to scan for viruses.

A regular disk defragmentation should be done to remove all unnecessary information that slows down the computer.

Disk defragmentation done at regular intervals helps the disc space to be used at an optimal level.

Take regular backup of the data on your computer. In case the data is lost due to any reason, system failure, virus attack, etc., you can easily retrieve your data using backup files till your last update.

System should be upgraded with new updates that were not there at the time of purchase, like, increasing RAM, to improve the performance. Also storage space should also be increased for storage of more information.

If you are getting some disc errors, then make sure that temporary internet files are deleted from time to time.

Software's should be updated regularly so that it works with maximum efficiency.



<b>QUESTIONS-1 MARK</b>		
1	<p>Here are the steps that take place when starting a computer. Rearrange the steps in the correct order. i) Desktop appears after login ii) Login screen appears iii) Power on Self-Test (POST) starts iv) Operating system starts v) Welcome screen appears</p> <p>a) i) -&gt; ii) -&gt; iii) -&gt; iv) -&gt; v)  b) ii) -&gt; iv) -&gt; iii) -&gt; v) -&gt; i)  c) iii) -&gt; iv) -&gt; v) -&gt; ii) -&gt; i)  d) iii) -&gt; v) -&gt; iv) -&gt; ii) -&gt; i)</p>	1
2	<p>Which one of the following is an example of Operating System?</p> <p>a) Microsoft Word  b) Microsoft Windows  c) Microsoft Excel  d) Microsoft Access</p>	1
3	<p>Given below are the steps to make a copy of folder 'D:\Myfolder' in 'C:\Documents'. Rearrange the steps in the correct order.</p> <p>(i) Right click anywhere in the folder and select Paste option from the shortcut menu or use Ctrl+V keyboard keys.  (ii) Select the C: drive and locate Documents folder.  (iii) Right click on Myfolder and select Paste option from the shortcut menu or use Ctrl+C keyboard keys.  (iv) (iv) Select the D: drive and locate Myfolder.</p> <p>(a) (iii) -&gt; (i) -&gt; (ii) -&gt; (iv)  (b) (iv) -&gt; (ii) -&gt; (iii) -&gt; (i)  (c) (iv) -&gt; (iii) -&gt; (ii) -&gt; (i)  (d) (i) -&gt; (ii) -&gt; (iii) -&gt; (iv)</p>	1
4	<p>Which of the following is not an example of Antivirus software?</p> <p>(i) McAfee (ii) Norton (iii) Disk Clean-up (iv) Kaspersky</p>	1
5	<p>Given below are the components of the taskbar in Windows 7. Rearrange the icons from left to right of the taskbar. (a)Date/Time (b) Start Button (c) Notification Area (d) File Explorer</p> <p>(i) (c) -&gt; (a) -&gt; (b) -&gt; (d) (ii) (b) -&gt; (d) -&gt; (c) -&gt; (a) (iii) (d) -&gt; (c) -&gt; (b) -&gt; (a) (iv) (a) -&gt; (b) -&gt; (c) -&gt; (d)</p>	1
6	<p>Which of the following is not a symptom of a computer affected with virus?</p> <p>(i) Computer stops responding (ii) Computer restarts on its own (iii) Computer can't open a permanently deleted file (iv) Computer runs very slowly</p>	1

7	The cleaning of software installed in the computer cannot be achieved by _____. a) Disk clean-up b) backup c) Cleaning CPU cabinet d) Installing antivirus software	1
8	Which of the following will you opt for saving a file? (a) save button on standard toolbar (b) save option from file menu (c) pressing Ctrl+S (d) any of the above	1
9	_____ is leakage of information stored in a computer. Ans. Security break	<u>1</u>
10	Picture for the desktop background is called ..... Ans: wall paper	1
11	ICT Stands for _____. a. Inform and Communicate technology b. Information and Communication technology c. Inform and Communication technology d. Information and Communicate technology	1
12	ICT Skills help us to _____, run our business and stay connected with our family and friends. a. Communicate b. Entertainment c. Both a) and b) d. None of the above	1
13	The most important software in any computer is the _____. a. Operating System b. Antivirus c. Office Package d. Photo Editing Software	1
14	Mobile devices also have an operating system like _____. a. Apple iOS b. Android c. Both a) and b) d. None of the above	1
15	_____ helps the computer to close all the applications, Operating system and turn off the computer. a. Sleep b. Shut down c. Hibernate d. None of the above	1

16	Which one of the following shortcut keys is used to paste a file? a. Ctrl + c b. Ctrl + p c. Ctrl + v d. Ctrl + x	1
17	What are the best options for caring for computer devices? a. Keeping a Device Clean b. Prepare a Maintenance Schedule c. Do not overcharge your battery d. All of the above	1
18	To clean the computer from the virus we required _____. a. Antivirus b. Office Package c. Photoshop d. Operating System	1
19	If we are using a computer for a long time we have to _____ unnecessary files and data from the computer. a. Delete b. Save c. Backup d. None of the above	1
20	Sometimes we get mails from companies who are advertising a product or trying to attract you to their website. Such mails are called _____. a. Trash b. Inbox c. Spam d. None of the above	1
21	What happens if you keep a device plugged in after it has been fully charged? a. It can break. b. It can overheat. c. It can stop functioning. d. Data can get corrupt.	1
22	What role does antivirus play in protecting your device? a. It can increase its performance. b. It can protect it from overheating. c. It can prevent data from getting corrupt. d. It can backup data.	1
23	Which option does not need to be enabled in order to keep a device cool? a. Make sure the computer's CPU fan is working. b. Keep the device unplugged when in use. c. Do not cover a laptop with a blanket. d. Avoid leaving the device in the sun.	1

24	Which of the following is required for keyboard maintenance? a. Use a very dilute combination of soap and water applied with a non-abrasive cloth to remove stains from the keycaps. b. Turn the keyboard upside down and shake it to remove foreign material. c. Blow dust and other particles with the help of a blower. d. All of the above.	1
25	What do you mean by Threats _____. a. Theft b. Virus c. Both a) and b) d. None of the above	1
26	If someone steals your desktop computer or laptop, it is referred to as _____ theft. a. Physical b. Identity c. Software Piracy d. None of the above	1
27	When a hacker takes your personal information and assumes your identity, this is referred to as _____ theft. a. Physical b. Identity c. Software Piracy d. None of the above	1
28	_____ are persons who try to attract you into inappropriate relationships. a. Trojan House b. Online Predator c. Theft d. None of the above	1
29	Sometimes you may receive very attractive offers saying you have won a huge amount of money in a lottery and that you can claim the prize by depositing a certain amount of money known as _____. a. Trojan House b. Online Predator c. Theft d. Internet Scams	1
30	We can check secure websites using _____. a. http:// b. https:// c. Www d. None of the above	1

DESCRIPTIVE QUESTIONS

1	<p>What do you mean by Operating System?</p> <p>Ans. Operating System: It is a software that acts as an interface between the user and the computer.</p>	1						
2	<p>Give two examples of mobile operating system.</p> <p>Ans. Two examples of mobile operating system :</p> <p>a. Apple iOS b. Google Android</p>	<u>2</u>						
3	<p>Name two operating systems for laptops or desktop.</p> <p>Ans. Two operating systems for laptops or desktop are:</p> <p>a. Ubuntu b. Microsoft Windows</p>	<u>2</u>						
4	<p>Identify me</p> <p>a. I am a physical part of computer. b. I am a collection of instruction doing specific task. c. I am the software that starts working as soon as we switch on a computer. d. I am an input device used to type text, numbers etc e. I am a small device that you can use to move, select and open items on your computer screen.</p> <p>Ans.</p> <p>a. Hardware b. Software c. Operating System d. Keyboard e. Mouse</p>	<u>5</u>						
5	<p>Differentiate between files and folder.</p> <p>Ans.</p> <table border="1" data-bbox="193 1357 1272 1704"> <thead> <tr> <th>File</th> <th>Folder</th> </tr> </thead> <tbody> <tr> <td>A place where information is stored in computer.</td> <td>A location where a group of files can be stored.</td> </tr> <tr> <td>It has a name and extension both</td> <td>It has only name.</td> </tr> </tbody> </table>	File	Folder	A place where information is stored in computer.	A location where a group of files can be stored.	It has a name and extension both	It has only name.	2
File	Folder							
A place where information is stored in computer.	A location where a group of files can be stored.							
It has a name and extension both	It has only name.							
6	<p>Write the extension for the following.</p> <p>a. A Notepad file b. A Sound File c. An image file</p> <p>Ans. Extensions are</p> <p>a. .txt</p>	<u>3</u>						

	b. .mp3 c. .jpg	
7	Write the steps to create folder on desktop?  Ans. The steps to create folder on desktop are: 1. Right-click on desktop and then choose the 'New Folder'. 2. Type the name of the folder.	<u>1</u>
8	Write the shortcut command for the following.  a. Cut  b. Copy  c. Paste  Ans. Shortcut commands are: a. Cut ———— Ctrl + X b. Copy ———— Ctrl + C c. Paste ———— Ctrl + V	<u>3</u>
9	What do you mean by Data Backup?  Ans. Backing up data means to save the information present on your computer on another device, such as CD/DVD drives or hard disk.	<u>1</u>
10	What do you mean by Spam?  Ans. We get mails from companies who are advertising a product or trying to attract you to their website. Such mails are called Spam.	<u>1</u>
11	How can you increase the performance of a computer?  Ans. We can increase the performance of a computer by a. Using an updated Antivirus Software b. Removing unnecessary files and data, such as temporary files and images.	<u>2</u>
12	What do you mean by Virus?  Ans. Viruses are computer programs that can damage the data and software programs or steal the information stored on a computer.	<u>1</u>
13	Name two types of Virus.  Ans. Worms and Trojan Horse	<u>2</u>
14	Write few tips to protect your data from online theft and viruses.  Ans. Few tips to protect our data from online theft and viruses are: a. Use passwords to login to your computer: b. Install Anti-virus and Firewall: c. Use Data Encryption	<u>2</u>

	d. Give details of your credit card or bank account only on secure sites	
15	What do you mean by threats to Computer?  Ans. Threats are the ways in which personal information can be leaked from a computer without our knowing.	<u>1</u>
16	List the various threats to a computer and its data.  Ans. The various threats to a computer and its data are:  1 Virus 2. Phishing 3. Online theft 4. Cyber crime	<u>2</u>
17	What is 's' in "https"?  Ans. 's' stands for secure.	<u>1</u>

**Answers(Objective questions – 1 mark)**

1	c) iii) -> iv) -> v) -> ii) -> i)
2	b) Microsoft Windows
3	(c) (iv) -> (iii) -> (ii) -> (i)
4	(iii) Disk Cleanup
5	(ii) (b) -> (d) -> (c) -> (a)
6	(iii) Computer can't open a permanently deleted file
7	c) Cleaning CPU cabinet
8	(d) any of the above
9	Security break
10	wall paper
11	b. Information and Communication technology
12	a. Communicate
13	a. Operating System
14	c. Both a) and b)
15	b. Shut down
16	c. Ctrl + v
17	d. All of the above
18	a. Antivirus

19	a. Delete
20	c. Spam
21	b. It can overheat.
22	c. It can prevent data from getting corrupt.
23	b. Keep the device unplugged when in use.
24	d. All of the above.
25	c. Both a) and b)
26	a. Physical
27	b. Identity
28	b. Online Predator
29	d. Internet Scams
30	b. https://



## UNIT 4

### **Entrepreneurial Skill**

An entrepreneur is an individual or a team, having an innovative idea, and takes every step to turn the idea into reality, while bearing the risks. Entrepreneurship is the process of setting up a business, taking it from an idea to realization. Entrepreneurship is the ability and readiness to develop, organize, and run a business enterprise, along with any of its uncertainties in order to make a profit.

#### **Entrepreneurship and society**

Entrepreneurship is simply described as starting a business using the resources available to a person. An entrepreneur combines factors in a creative manner in order to generate value for customers and create wealth.

Society is described as an aggregate of people living together in a community, who associate for various engagements including business.

Entrepreneurship is the attitude of mind to seek opportunities, take calculated risks and derive benefits by setting up a venture. It comprises of numerous activities involved in conception, creation, and running an enterprise.

The beauty of entrepreneurship in a society is that as businesses prosper the impact the businesses create also increases. It is due to entrepreneurial activity that the society is provided with goods and services. In turn, society provides market for products and services provided by the entrepreneur.

Positive impact of entrepreneurship on society:

- Accentuates economic Growth
- Fosters Creativity
- Stimulates Innovation and Efficiency
- Creates Jobs and Employment Opportunities
- Solves the problems of the society
- Encourages welfare of the society

Role of society in boosting entrepreneurship:

- Creates needs and demands
- Provides raw materials
- Enables financial support
- Creates a need for education
- Catalyses policy formation and reform
- Facilitates networking
- Supports infrastructure development

Entrepreneurship also creates some adverse impact on society at times like:

- environmental degradation
- trade imbalance
- labour exploitation etc.

### **Common entrepreneurship activities related to society:**

#### **Social Entrepreneurship:**

*Social entrepreneurship can be understood as creation of sustainable solutions for social problems that leads to social change by employing entrepreneurial mind-set, processes and operations.*

In social entrepreneurship research is conducted to completely define a specific and core social problem. Many social problems are tackled by social entrepreneurs such as low reach of quality education, health and sanitation, unemployment, child labour etc.

**Agricultural Entrepreneurship:** *Agricultural Entrepreneurship can be defined as being primarily related to the marketing and production of inputs and products used in agricultural activities.* Farmers have benefited the most with rise in agricultural entrepreneurship as it has led to low-cost innovations in farming processes.

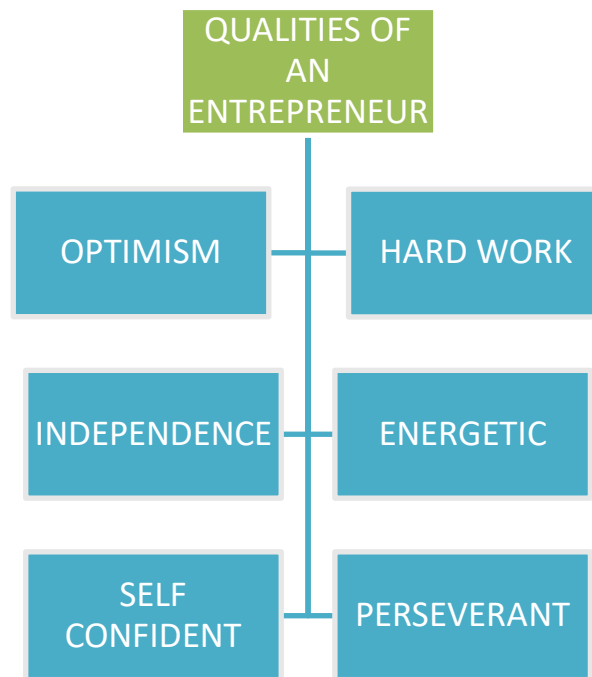
**Women Entrepreneurship:** *Women entrepreneurship is referred to the entrepreneurial activity led by women, where women undertake risks, create enterprises, organise factors of production, innovate with products/services, and generate employment opportunities.*

Government of India has defined women entrepreneurship as *“an enterprise owned and controlled by a woman having a minimum financial interest of 51 per cent of the capital and giving at least 51 per cent of the employment generated in the enterprise to women.”*

**Small Scale Entrepreneurship:** Small scale entrepreneurship refers to starting industries in which manufacturing, trading, providing services, productions are done on a small scale or micro scale. These businesses serve as the backbone of many developing countries.

#### **Qualities of an Entrepreneur**

The qualities of an Entrepreneur are the key value to success. They play the role to guide the person to achieve his/her goal. Some qualities of an Entrepreneur are stated below:



**Hard work:** Entrepreneur work hard to be successful. Entrepreneurs use a lot of trial and error and keep putting in work till they succeed.

**Optimism:** Positivity and belief in what they do is what takes entrepreneurs far in their journey. Entrepreneurs should not think negatively or be afraid of adverse situations. For an entrepreneur, part of being optimistic is about learning from mistakes and failures and finding alternative ways to do things.

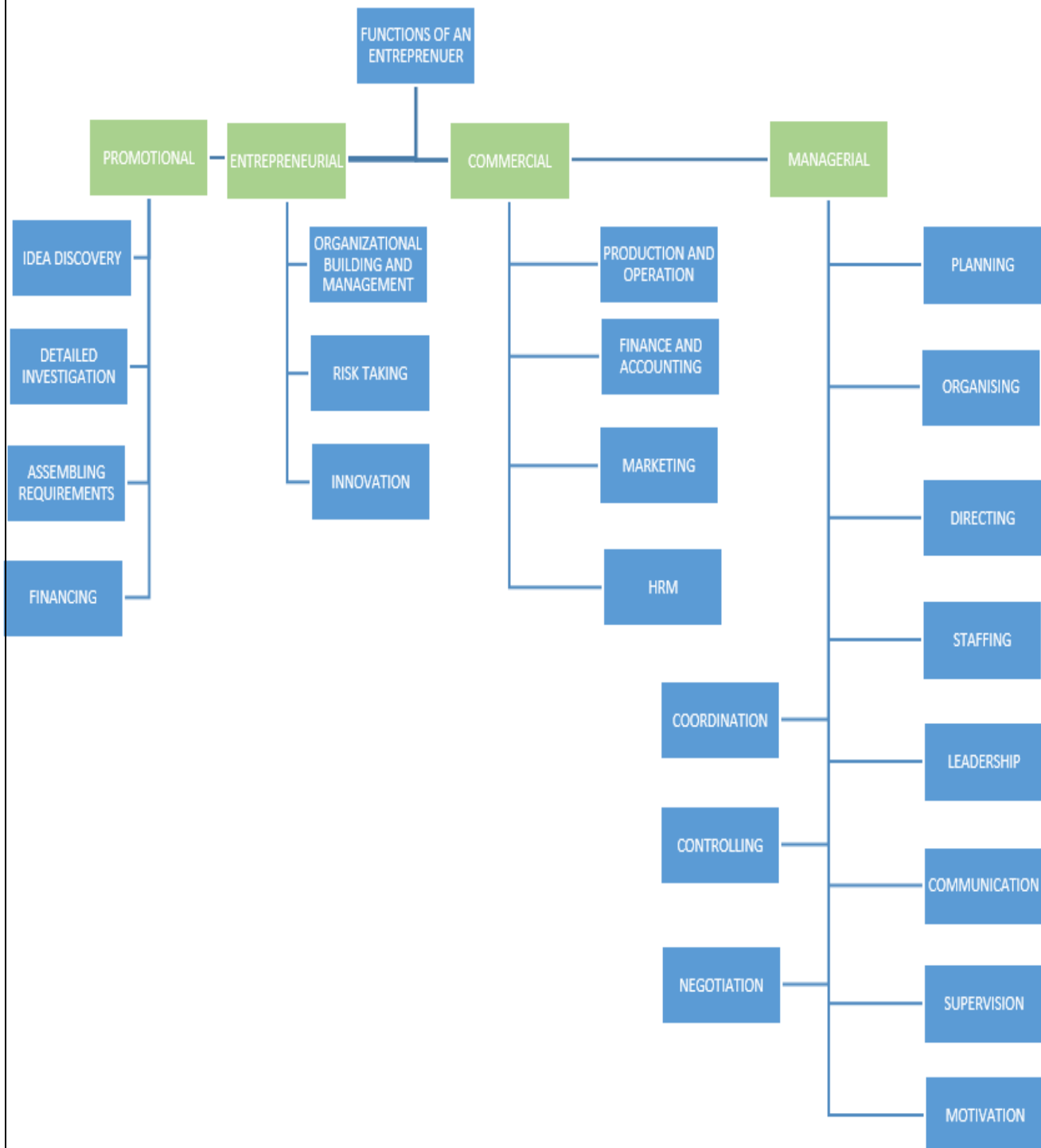
**Independence:** Entrepreneurs prefer to be their own master and not work under someone else. Entrepreneurs like the independence to drive a business on their own.

**Energetic:** Drive and energy is always high in successful entrepreneurs which makes them extremely proactive. They are continuously taking actions to try multiple approaches and execute things.

**Self-confident:** Belief in one's own vision and abilities and passion for the goal makes successful entrepreneurs confident. Entrepreneurs are able to transfer this passion and vision to investors, employees, customers etc. to sell their idea to every stakeholder.

**Perseverant:** A way of thinking that helps to accept failure, learn from mistakes, not give up, continuously experiment etc. is crucial for an entrepreneur. Hence, entrepreneurs need to be perseverant in their pursuit.

## Functions of an Entrepreneur



## **Entrepreneurial functions**

### **Organisation Building and Management:**

- Organisation building is about bringing together different factors of production and allocating these resources to bring down costs and losses.
- All decisions relating to an enterprise are taken by the entrepreneur.
- An entrepreneur builds the organization by taking various steps such as hiring employees, organizing the factors of production, sourcing finance etc.

### **Risk taking:**

- Risk taking is about taking responsibility and planning for a loss or mishap that may occur in the future due to unforeseen contingencies.
- Some common risks entrepreneurs take are around return on investment, hiring of new employees, working with vendors etc.
- An entrepreneur plays the function of developing a certain risk-taking appetite and taking calculative risks to reduce adverse consequences.

### **Innovation:**

- Entrepreneurs innovate by introducing new concepts, products, services, designs, ideas etc.
- They may introduce something new and innovative in any branch of economic activity.
- An entrepreneur foresees a potentially profitable opportunity and innovates in the effort to exploit it.

## **Promotional functions**

### **Idea Discovery:**

- The first step towards entrepreneurship is discovery of a business idea.
- An entrepreneur comes up with a business idea and thinks about ways to implement it.
- It is about seeking opportunities for a specific type of business and finding ways to commercialise it.
- Usually, entrepreneurs work around the process of idea discovery by exploiting natural resources, finding a market need or calculating the profit potential.

### **Detailed Investigation:**

- While coming up with ideas can seem like an easy process, the challenge is to understand if the idea has the potential to turn into a viable business venture.
- For this, an entrepreneur conducts research, investigates and evaluates an idea considering various factors and estimates the total demand for a new product or service.

## **Assembling the Requirements:**

- Some basic business requirements include infrastructure or office space, human resources, key vendors or partners, working capital etc.
- In a manufacturing or product-based business, some requirements are selecting the factory site, sourcing plant and machinery, hiring staff, finding the right suppliers etc.
- No matter what is the type of the business, an entrepreneur has to work towards assembling and organising all the requirements once he/she is sure about the practicality and profitability of the proposition.
- Once this function is performed, the project is set to start smoothly.

## **Financing:**

- Raising capital for a business is one of the core functions that entrepreneurs perform themselves, not just at the initial stage of the business, but even to grow and scale the business.
- First, the requirements of finances are estimated. Next, the sources from which capital will come are determined.
- This includes calculating the long-term and short-term financial requirements and considering the debt equity ratio.

## **Managerial functions**

### **Planning**

- An entrepreneur documents a business idea in the form of a business plan, to detail each element of the business such as product or service description, operations, marketing, finance, accounting, growth plan etc.
- A business plan serves as a guide to determine the business objectives and the course of action.
- *It helps to detail the “what, when, how and who” of doing every specific task.*

### **Organizing**

- Organizing in the managerial context refers to setting specific and attainable goals and objectives to be achieved by different departments and by each employee.
- It is about arranging, directing, guiding, coordinating, and controlling the key business activities

### **Directing**

- Directing is about initiating planned action and ensuring that each employee is performing effectively.
- This also includes doing continuous performance reviews and organizing tasks according to plans.

## **Staffing**

- Staffing refers to different sub-processes around human resource management, such as manpower planning, recruitment, selection, placement, training, transfer, salary, promotion, payroll, appraisal, etc.
- The objective of staffing is to fill a particular position with the right employee at the right time.

## **Leadership**

- Leadership is more of a skill than a function for an entrepreneur as he or she has to lead, guide and supervise people who work for the business.
- It is the process by which an entrepreneur directs, guides and influences the work of others in choosing and attaining specified goals by mediating between the individual and organization in such a manner that both get maximum satisfaction.

## **Communication**

- An entrepreneur has to communicate every single day, in the form of writing, responding, drafting emails, verbal instruction, discussion, etc.
- Entrepreneurs spend 75% to 90% of their working time communicating with others.
- It refers to the exchange of ideas, feelings, emotions, knowledge, and information between two or more persons.
- Nothing happens in management until effective communication takes place.

## **Supervision**

- After issuing instructions, the entrepreneur has to see that the given instructions are carried out.
- Supervision refers to the job of overseeing subordinates at work to ensure the maximum utilization of resources, to get the required and directed work done, to correct the subordinates whenever they go wrong, and ensure each function of the business runs smoothly.

## **Motivation**

- Along with guiding employees, an entrepreneur also plays the role of motivating them and encouraging positive behavior and culture within the organization.
- Motivating employees is about creating an urge in them to exhibit the desired behavior and positive attitude towards work.
- Employees with high motivation automatically do other things along with it to perform successfully, such as being productive, flexible, competitive, comprehensive, efficient, etc.

## **Co-ordination**

- Coordination between different departments of the business helps to ensure that work happens in a timely manner.
- Activities of all employees must be channelized towards goal achievement.
- An entrepreneur has to set certain targets, measures, goals, etc.

- With different departments to ensure all are coordinating and working effectively internally as well.

### **Controlling**

- Sometimes controlling is necessary for the entrepreneur to set company rules and policies.
- The controlling function helps the entrepreneur to set performance standards, measure and compare productivity and performance, identify variations, take corrective action, etc.

### **Negotiation**

- An entrepreneur negotiates terms and conditions for many parts of the business such as payment terms and timelines, salaries of employees, vendor quotations, etc.

### **Commercial Functions**

#### **Production and Operations**

- Depending on whether it is a service business or product business, an entrepreneur has to perform the function of managing production or operations.
- For a manufacturing business, production-related activities include sourcing raw materials, checking the functioning of machinery, utilizing maximum capacity, meeting order requirements, etc.

#### **Finance and Accounting**

- While finance is more focused on raising funds and managing them, accounting helps to record and analyze the financial position of the business.
- Thus, an entrepreneur has to prepare and analyze cash flow statements, income sheets, balance sheets, etc.

#### **Marketing**

- Marketing is about moving the product or service from the producer into the hands of the end customer or user.
- It involves promotion, advertising, distribution, customer service, etc
- An entrepreneur has to perform this function to make people aware of the offerings of the business and makes sales.

#### **Human Resource Management**

- Human Resource Management (HRM) refers to the recruitment, employment, selection, training, development, and compensation of the employees within an organization.
- An entrepreneur performs this function as no business can function without people.

### **Role of entrepreneurs:**

#### **Innovator's Role**



Entrepreneurs innovate by bringing unique and new products and services into the market. Innovation in the industry results in higher production efficiency which has led to an increase in employment and income levels.

### **Agent's role**

Entrepreneurs are perceived as 'Agents of Change'. They identify the opportunities, establish enterprises, and build up industries which in turn lead to the overall development of the economy.

### **Coordinating role**

An entrepreneur has to coordinate the various factors for production. It involves the selection of the best possible combination of factors.

### **Risk assumption role**

The fruit of bearing risks can be profit, which leads to wealth generation for the overall economy. Entrepreneurs retain some amount of the profits earned and put it back into the business. Therefore, by assuming risk entrepreneurs contribute to the economy.

### **Capital formation role**

Entrepreneurs enable the formation of capital by mobilizing idle savings for the purpose of carrying on the business. This mobilization of capital leads to the development of assets, trade activities, an increase in capital availability, and economic development.

### **Imitating role**

In developing nations, entrepreneurs usually imitate or adopt the innovations done by the entrepreneurs of the developed nations. These innovations are adapted according to the local needs and conditions and work towards overcoming entrepreneurial challenges.

### **Employment Generation role**

The establishment of business enterprises leads to the generation of employment opportunities as various human resource professionals are needed to run the business effectively. Hence, entrepreneurship solves the problem of unemployment, which is a major problem in economic development.

### **Status transformation role**

Entrepreneurs generate employment, income, and wealth which improves the overall standard of living in society. Improved standard of living leads to economic development as it reduces the disparity in income.

### **Balancing role**

Entrepreneurship is encouraged with small and micro enterprises and small-scale industries as well. This encourages regional development and removes development imbalances in the economy

## IMPORTANCE OF AN ENTREPRENEUR

### Free market evolution

- Entrepreneurs are important in a free market because they help the market respond to changing prices and consumer preferences.
- Entrepreneurs bring change in technology, trends, and markets.
- For example, with an increase in digital services, entrepreneurs have created companies that offer many home delivery services such as groceries, restaurant food, clothes, accessories, etc.

### Efficiency improvements

- A successful entrepreneur tends to adapt to an established business and increase their own efficiency.
- They innovate with current systems and introduce new technologies which can significantly create advancement in the industry.
- Hence, during any major changes in the economy, entrepreneurs adapt and do not have to go out of business.

### New markets

- Entrepreneurs can often 'redefine the rules' of an established industry.
- They do this by creating new markets for existing products and slightly innovating in small ways to suit the needs of a new target market.

### New values

- Sometimes, entrepreneurs choose ethics over profit and offer a more ethical product to the world, and are transparent about it.
- For example, Jaipur Rugs has multiple artisans who work towards making rugs that are sold around the world.
- However, Jaipur rugs are very transparent about their artisan community and they ensure that artisans are given a fair share of profit.

## MYTH ABOUT ENTREPRENEURSHIP

a) **Entrepreneurs are born, not made:** It is an assumption that entrepreneurial qualities are inborn and that only people with certain natural talents can become entrepreneurs. This is a myth and research had established that almost anyone can be an entrepreneur with the right skills, drive and passion.

b) **It takes a lot of money to start a business:** While certain amount of capital is required for take a business off the ground, it varies depending on the business. The key in entrepreneurship is to start with resources available and grow slowly and steadily

c) **Entrepreneurs take risk:** While entrepreneurs definitely have to bear some risks, they do not necessarily put themselves in high-risk situations. Entrepreneurs take calculated risks and weigh risk versus reward.

d) **Businesses either skyrocket or fail**

e) **Great ideas are what makes entrepreneurs:** People who are able to execute the idea and turn it into a business are referred to as entrepreneurial. Entrepreneurs do not necessarily reinvent the wheel. Many times, they take existing ideas to make a business out of it.

f) **One must know everything before starting a business:** Entrepreneurs continuously thrive to be in a constant state of learning. What actually counts is not what you know, but how fast you can learn.

## **ENTREPRENEURSHIP AS A CAREER OPTION**

1. Nurtures development of entrepreneurial skills and capabilities
2. Enables the application of an entrepreneurial mindset
3. Develops the ability to handle failure and ambiguity
4. Enhances critical thinking and problem-solving ability
5. Provides early exposure to the real world
6. Inspires to think about one's career differently
7. Leads to create a difference in society

\*\*\*\*\*

### **A. MCQ QUESTIONS: (Each question carries 1 mark)**

1. \_\_\_\_\_ is the type of employment where one is running a business to satisfy the needs of people and looking for ways to make the business better.
  - a. Entrepreneurship
  - b. Entrepreneur
  - c. Business plan
  - d. entrepreneurship
2. **Successful entrepreneurs have the \_\_\_\_\_ abilities.**
  - a. They are confident
  - b. They keep trying new ideas
  - c. They are creative
  - d. All of the above
3. **An \_\_\_\_\_ is a person who is self – employed, is willing to take a calculated risk, and brings in a new idea to start a business.**
  - a. Software Engineer
  - b. Entrepreneur
  - c. Civil Engineer
  - d. Mechanical Engineer
4. **The process of developing a business plan, launching and running a business using innovation to meet customer needs and to make a profit is \_\_\_\_\_.**

- a. Software Engineer
- b. Entrepreneur
- c. Civil Engineer
- d. Mechanical Engineer

**5. A self-employed person who is always trying to make his/her business better by taking risks and trying new ideas is an \_\_\_\_\_.**

- a. Business Man
- b. Entrepreneur
- c. Employer
- d. None of the above

**6. What do entrepreneurs do when she/he runs their business?**

- a. Fulfill Customer Needs
- b. Use Local Materials
- c. Create Jobs
- d. All of the above

**7. When a person begins a business, he or she may encounter several challenges and failures. Even while taking a significant risk, an entrepreneur must think \_\_\_\_\_.**

- a. Positively
- b. Negatively
- c. Both a) and b)
- d. None of the above

**8. It is necessary for an entrepreneur to continuously \_\_\_\_\_ towards his/her own and company's goals.**

- a. Work Hard
- b. Always take rest
- c. Not participate actively
- d. None of the above

**9. Entrepreneurs need to be open to \_\_\_\_\_ and try them without fear of failure.**

- a. Invest all of money
- b. New Ideas
- c. Both a) and b)
- d. None of the above

**10. Experimenting with many ideas is a quality related to \_\_\_\_\_.**

- a. Perseverance
- b. Confidence
- c. Creativity
- d. Trial and error

**11. An entrepreneur should be able to see a problem from different perspectives and come up with original and \_\_\_\_\_.**

- a. Creative Solutions
- b. New Ideas
- c. Both a) and b)
- d. None of the above

**12. An entrepreneur should be willing to take a \_\_\_\_\_ and is always open to new ideas to make his/her business grow.**

- a. Satisfying human need
- b. Product and Service
- c. Calculated Risk
- d. Regular Production

**13. Ravi's customer comes to his store and starts shouting at him. He does not get angry. He listens to what his customer is saying. He is \_\_\_\_\_.**

- a. Hardworking
- b. Confident
- c. Patient
- d. Prying new ideas

**14. Susheela decides to sell her company tyres in Sri Lanka. It does not sell and she has a loss. She apologizes to the people who work for her. She says she will plan better next time. She \_\_\_\_\_.**

- a. takes responsibility for your mistakes
- b. thinks before making a decision
- c. does not give up
- d. is creative

**15. A myth, or a misconception about entrepreneurship is \_\_\_\_\_.**

- a. To start a business we required lot of money
- b. Business should be unique or special
- c. entrepreneurs are born, not made
- d. All of the above

16. Ramya and Ramu both own plant shops. Ramu sits at his shop every day. When customers come, he sells to them. Ramya walks around and gets customers to her shop. She also sells seeds and flowers. Who is Entrepreneur out of Ramya and Ramu.

- a. Ramya
- b. Ramu
- c. Both of the above
- d. None of the above

17. What do entrepreneurs do when they run their business?

- a. They help in increasing jobs in their area.
- b. Helping the people in the society to earn money.
- c. Both of the above
- d. None of the above

18. Which of the following entrepreneurship refers to starting industries in which manufacturing, trading, providing services, productions are done on a micro scale?

- a. Women Entrepreneurship
- b. Agricultural Entrepreneurship
- c. Small Scale Entrepreneurship
- d. None of the above

19. An enterprise owned and controlled by a woman and giving at least 51 per cent of the employment generated in the enterprise to women is \_\_\_\_\_

- a. Agricultural Entrepreneurship
- b. Small Scale Entrepreneurship
- c. Social Entrepreneurship
- d. Women Entrepreneurship

20. Mary buys bulbs for her business from Noida. She learns that bulbs are cheaper in Faridabad. So, she decides to start buying bulbs from there.

- (a) Makes decisions
- (b) Divides income
- (c) Takes risk

ANSWERS

1	a	5	b	9	b	13	c	17	c
---	---	---	---	---	---	----	---	----	---

2	d	6	d	10	d	14	a	18	c
3	b	7	a	11	c	15	d	19	d
4	b	8	a	12	c	16	a	20	a

## B. DESCRIPTIVE QUESTIONS

### 1 MARK QUESTIONS:

1. What do you mean by Entrepreneur?

Ans: Entrepreneurs are people with vision who recognize and pursue opportunity, create and establish business or new ventures, take into account the risk involved by using available resources.

2. What do you mean by Entrepreneurship?

Ans: Entrepreneurship is the organizing an enterprise to undertake a new production process, raising capital, arranging labour and raw materials, etc.

3. Entrepreneurs are not job seekers but they create opportunities of employment for people. (True/False)

Ans. True.

### 2 MARK QUESTIONS:

1. Explain any two role of entrepreneurs?

Ans. Innovator's Role: Entrepreneurs innovate by bringing unique and new products and services into the market.

Risk assumption role: Entrepreneurs are not risk averse and they realize that taking risks is a part of business.

Employment Generation role: Entrepreneur solves the problem of unemployment by generating jobs and employing people.

2. State any two benefits of Entrepreneurship to society.

Ans.

- a) Entrepreneurs provide new job opportunities
- b) Entrepreneurs increase competition & boost productivity
- c) Entrepreneurs create new business & new markets.
- d) Entrepreneurs add national income.
- e) Entrepreneurs introduce innovative technology and low cost products

3. What is meant by Women Entrepreneurship?

Ans. Women entrepreneurship is referred to the entrepreneurial activity led by women, where women undertake risks, create enterprises, organize factors of production, innovate with products/services and generate employment opportunities.

4. What is meant by Agricultural Entrepreneurship?

Ans. Agricultural Entrepreneurship can be defined as being primarily related to the marketing and production of inputs and products used in agricultural activities.

5. What is meant by Social Entrepreneurship?

Social entrepreneurship can be understood as creation of sustainable solutions for social problems that leads to social change by employing entrepreneurial mind-set, processes and operations. In social entrepreneurship research is conducted to completely define a specific and core social problem.

6. Define Small Scale Entrepreneurship?

Ans. Small scale entrepreneurship refers to starting industries in which manufacturing, trading, providing services, productions are done on a small scale or micro scale.

7. What do you mean by business plan?

Ans. A business plan is a document that thoroughly explains a business idea and how it will be carried out. It defines in detail a company's objectives and how it plans to achieve its goals.

8. List any two qualities of an entrepreneur.

Ans. Hard work, optimism, independence, energetic, self- confident, perseverant.

9. What are the main commercial functions of an entrepreneur?

Ans. The commercial functions are production, finance, marketing, personnel and accounting.

10. List any difference between wage employed and self-employed people.

Ans. Wage employed people are people who work for a person or an organization and get paid for that work.

Self-employed people are those who start businesses to satisfy the needs of people.

11. What are the characteristics of Entrepreneur?

Ans. a) Economic: Entrepreneurship is an economic activity because it involves the creation and operation of an enterprise with a view to creating value or wealth by ensuring optimum utilization of resources.

b) Innovation: Entrepreneurship involves a continuous search for new ideas and innovation. Innovation occurs through the introduction of a new quality in a product, a new product.

c) Profit potential: Before starting a new business, evaluate the expected returns from the business.

d) Risk bearing: The essence of Entrepreneurship is the willingness to take risk arises out of the creation and implementation of new ideas.

e) Decision making: Entrepreneurship is making right and correct decisions tr appropriate time by entrepreneur. A correct decision results in success in business venture.



f) Managerial skills: The Entrepreneur must have right managerial skills so as to handle the group of people efficiently.

g) Organization building: It implies skills to build an organization. Building an organization is important part of Entrepreneurship development.

12. How Entrepreneurship is helpful to society? Explain.

Ans:

a) Helps in Wealth creation and sharing: By establishing Business entity, entrepreneurs invest their own resources and attract capital from investors, lenders and the public.

b) Creating Employment Opportunities jobs: Entrepreneurs are by nature and definition job creators, as opposed to job seekers.

c) Innovation: Entrepreneurs use businesses to create products and services that solve problems in innovative ways. Their products and services must be functional and they must be designed to be cost effective.

d) Balanced Regional Development: Entrepreneurs setting up new businesses and industrial units help with regional development by locating in less developed and backward areas.

e) Improves Standards of Living of People: Increase in the standard of living in a community is another key goal of economic development. Entrepreneurs play a key role in increasing the standard of living in a community. They do this not just by creating jobs, but also by developing and adopting innovation that led to improvement in the quality of life of their employees, customers and other stakeholders in the community.

13. Write a note on Entrepreneurship as career option.

Ans:

a) Nurtures development of entrepreneurial skills and capabilities.

b) Develops the ability to handle failure and ambiguity.

c) Enhances critical thinking and problem-solving ability

d) Provides early exposure to the real world

e) Leads to creating difference in society

f) Inspires to think about one's career differently

14. What do you think are the important functions of an entrepreneur? Write your answer giving suitable examples.

Ans.

The functions of an entrepreneur are:

- Making Decisions: An entrepreneur makes decisions every day. This includes what to produce or sell, how much and where to sell.
- Managing the Business: An entrepreneur plans the future of his or her business. He/she arranges for raw material, hires people for work, and tells everyone what to do. They also check if the plan is being followed.
- Divide Income: The entrepreneur divides the business money into many groups. He/she spends money to buy material, pays rent of the building and salaries to people.

- Taking Risk: Risk is the chance of something going wrong. An entrepreneur takes risks against fires, lost items and theft.
- Create a new Method, Idea, or Product: An entrepreneur is always trying new things. He/she does this to increase their importance and income.

15. What do entrepreneurs do when they run their business?

Or

List the ways in which an entrepreneur affects a society.

Ans. –

- Fulfil Customer Needs** – A product or service that people want is referred to as demand. Entrepreneurs discover what people desire. Then students use their imaginations to come up with a business plan to address that demand.
- Use Local Materials** – Entrepreneurs produce low-cost items by using the materials and people available to them.
- Help Society** – Entrepreneurs have a good interaction with the general public. They gain money by doing things that help society. Some business people donate money to create schools and clinics, while others work to save the environment.
- Create Jobs** – They buy more material, and from more people. They also hire more people to work for them. In this way, more people have jobs.
- Sharing of Wealth** – Wealth means having enough money to live a comfortable life. As entrepreneurs grow their business.
- Lower Price of Products** – The price of a product decreases when more entrepreneurs sell the same thing. In India, for example, as more mobile phones were sold, the cost of the phone decreased.

16. List any five qualities of the entrepreneur?

They are confident. They believe in themselves and their abilities.

They keep trying new ideas in their business.

They are patient.

They are creative and think differently about business ideas.

They take responsibility for their actions.

They make decisions after thinking about them.

They work hard.

They do not give up when they face a difficulty

17. Write any four Functions of entrepreneurship?

Ans. Planning, organizing, decision making, managing, innovating, risk bearing, etc.

18. How do entrepreneurs contribute to society?

Ans. Entrepreneurs contribution to the welfare of society is of high order. A business person apart from making money for him or herself also helps the society in many ways financially and socially. Also they contribute in form of donations, sponsorship, welfare programs, advisors to respective government, etc.

19. Mention four important roles of an entrepreneur.

Ans. Four important roles of an entrepreneur are:

Innovator's role

Agents' role

Innovator

Risk Assumption

Capital formation

Employment generation

20. Is entrepreneurship a career choice?

Ans. Entrepreneurship is becoming the most pursued career choice. The term entrepreneurship is defined as the type of self-employment where one is running a business and looking for ways to make the business better to make profits.

21. "Entrepreneurs are born, not made." Do you agree with this statement? Justify your answer.

Ans. No, this is a myth/misconception about entrepreneurship.

Being an entrepreneur starts with a way of thinking. One must believe that anything is possible and it shall be achieved. It starts with thinking of an idea that you want to work on, making it different.

22. Entrepreneurship has a positive impact on society. Write down any two.

Ans.

1. Some of them work towards saving the environment.
2. Some of them give money to build schools and hospitals.

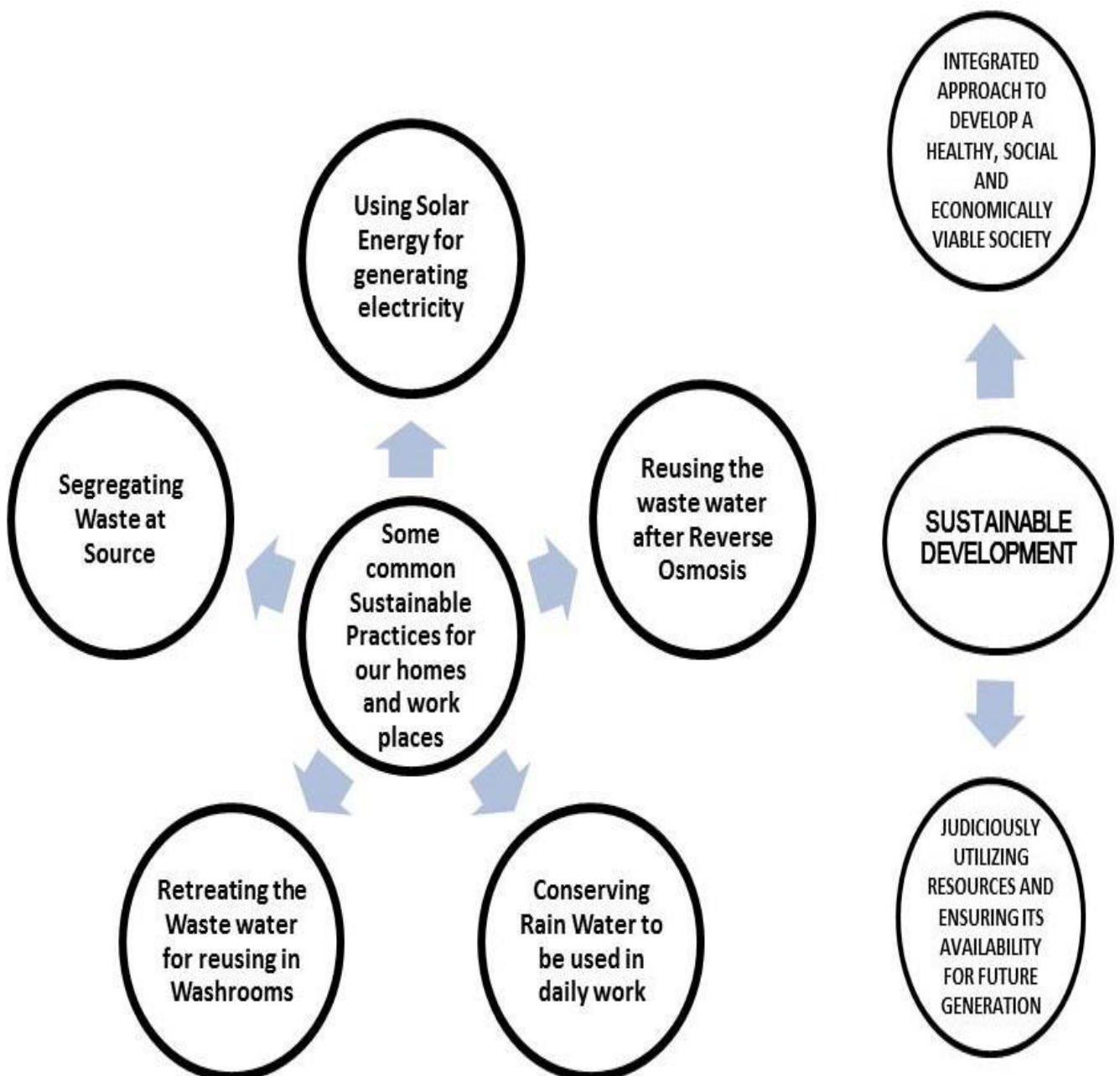
23. What is the difference between a businessman and an entrepreneur?

Ans. A **businessman** walks on the defined path, but an **entrepreneur** believes in making his own path, which becomes a guideline for other businessmen.

## **Unit 5** **GREEN SKILLS**

### **SUSTAINABLE DEVELOPMENT**

As the human race progressed, we neglected the vitality of nature in our lives. In pursuit to fulfil our unending wants we started exploiting the nature that has resulted in what we see today, the scarcity. There is scarcity of clean water to drink, scarcity of pure air to breathe, scarcity of unadulterated food, rising issue of global warming, depletion of ozone layer.



Everyone in the world today is talking about the measures to curb these rising problems. There are World Summits being organised to find a solution to these global problems. And the solution to these problems is only one – **SUSTAINABILITY**.

‘The ability to be maintained at a steady level’ is SUSTAINABILITY.

- *Collins English Dictionary*

Sustainability focuses on how human beings can live in peace and harmony with nature without creating ecological disturbance. The aim is that we visualize the long term impact of our actions on environment and take corrosive measures to maintain balance between our demands and the supply of natural resources.

### SUSTAINABLE DEVELOPMENT



The concept of sustainable development received its first major international recognition in 1972 at the UN Conference on the Human Environment held in Stockholm.

Sustainable development is the “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.

- *Brundtland Report – Our Common Future, published in 1987 by the World Commission on Environment*

*and Development (WCED)*

Sustainable development focuses on long term, integrated approach to develop a healthy, social and economically viable society. The aim is to inculcate the value of self-resistance amongst the people to save natural resources for everyone to utilize judiciously and still ensuring its availability for future generations.

### 4 R'S AND 1 U OF SUSTAINABILITY

In our daily life we can contribute to create a Sustainable Society by following 4Rs' and 1U of Sustainability. These are **REFUSE, REDUCE, REUSE, RECYCLE** and **UPCYCLE**.

**REFUSE** - Not to use products that may not harm the environment.

**REDUCE** - To minimize the use of the products that may cause harm to the environment.

**REUSE** - To reuse products as far as possible, in order to reduce the waste generation.

**RECYCLE** - After reusing the product, we must try to recycle it as far as possible.

**UPCYCLE** - Any product that is not usable can be upcycled with creativity and innovation. It gives a new look to the old product and makes it look desirable.



## IMPORTANCE OF SUSTAINABLE DEVELOPMENT

In the 21st Century the importance of adopting sustainable techniques for sustainable development is of grave importance.

1. Judicious use of resources is of prime importance since the exploitation of resources is causing its depletion. We need to curb our usage to ensure that resources like air, water, forests are available to future generation. This would also mean that the resources are in their pure form.

2. Not only for the next generation but even for the existing generation, the quality of basic resources is deteriorating

leading to major health concerns such as Cancer, Bronchitis etc. Ensuring sustainability will help curb these problems.

3. Rising demands is leading to economic disparity. The rich is becoming richer while the poor is becoming poorer. The uneven distribution of available resources across different economic fronts is leading to discrimination, giving rise to crime and creating social imbalance. To ensure proper balance Sustainability is important.

4. Environmental problems like Climate Change, Emission of Green House gases are alarming. If everyone draws a line for themselves, we will be able to combat these issues with the help of Sustainable Development.



5. Adoption of Sustainable Development in our daily life and at our work place will also promote economic growth. Young entrepreneurs with minimum investment can produce better output. Introduction of Solar Power Plants, Waste Water Treatment Plants, Electric Vehicles etc. will not only help in protecting Environment but shall also contribute in Saving money and resources. The

economy that reduces environmental risks and strikes ecological balance is termed as Green Economy.

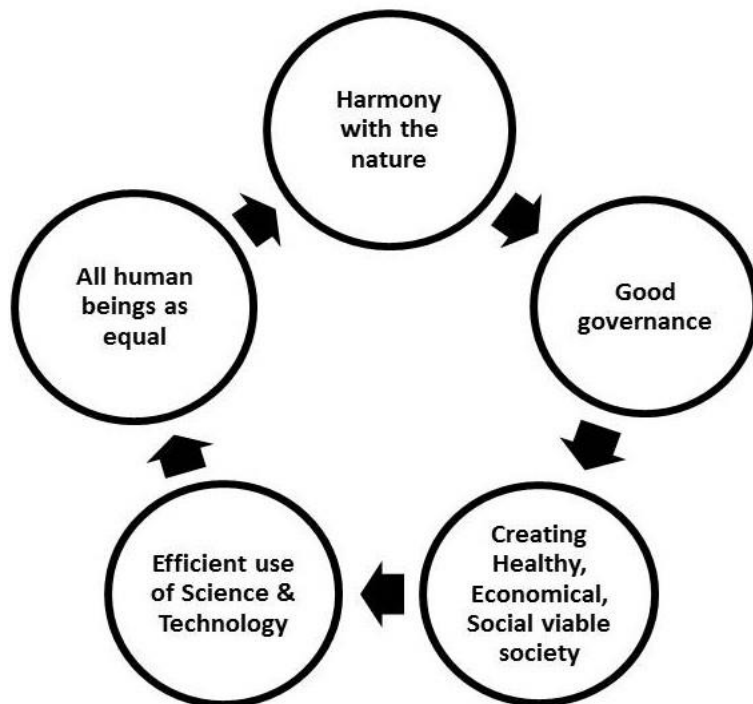


Fig. DRIVING FORCES TO PROMOTE SUSTAINABLE DEVELOPMENT

### DRIVING FORCE TO PROMOTE SUSTAINABLE DEVELOPMENT

The following may be considered as the driving force to promote Sustainable Development:

- i. Protecting and living in harmony with the Nature
- ii. Considering all human being as equal
- iii. Promoting good governance
- iv. Using Science & Technology responsibly
- v. Creating healthy, social and

economically viable society

### SUSTAINABLE DEVELOPMENT GOALS

To ensure that Sustainable Development is ensured in our communities and world at large United Nations Member States in 2015 adopted 17 SDGs (Sustainable Development Goals) as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. These are:

1. poverty
2. Zero Hunger
3. Good Health and Well Being
4. Quality Education
5. Gender Equality
6. Clean water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry Innovation and Infrastructure



- 10.Reduced Inequalities
- 11.Sustainable Cities and Communities
- 12.Responsible Consumption and Production
- 13.Climate Action



- 14. Life Below Water
- 15. Life on Land
- 16. Peace, Justice and Strong Institution
- 17. Partnership for the Goals

**PROBLEMS RELATED TO SUSTAINABLE DEVELOPMENT**

To achieve Sustainability for next generation, the whole world needs to come as one. This is the biggest challenge in realising this goal because of the following reasons:

1. A large population in major parts of the world is living an underprivileged life and is excluded. For them earning a meal each day is a challenge. Under such circumstances, expecting an alteration in their mind set or behaviour is not easy.
2. A huge population in world’s economy is unemployed. Any means of earning whether sustainable or not is their ray of hope.





3. With the existing issues of climate change, number of species has extinct and many are on verge of their extinction. Under such circumstances striking a balance in the food chain is a big responsibility.
4. The market all over the world is trying to capture as many resources as possible to maximize their profit. In pursuit of maximising the profit they overuse and exploit the resources.
5. In the time of nuclear race, where every developing country is trying its hand to become developed nation, ensuring world peace is a global challenge.
6. It is the responsibility of every country to ensure having a full proof policy towards Sustainable Development. While the challenge remains that many are simply leaving loose ends in the execution of policies.
7. Last but most important, while it is the responsibility and accountability of every individual to promote Sustainable Development, there is a huge world population which is simply insensitive towards its need.

#### QUESTIONS

1 mark QUESTIONS	
1.	There are _____ SDGs given by the United Nations.  17
2.	SDGs stand for _____  Sustainable Development Goals
3.	Give any one practice / sustainable process that is being used to help preserve the environment.  organic farming/ vermicomposting
4.	When and where Sustainable Development Goals were launched?  United Nations Sustainable Development Summit in New York in September 2015.
5.	What is Sustainable Development?  Sustainable development is the development that satisfies the needs of the present without compromising the capacity of future generations.
6.	What do you mean by Sustainable Development Goals?

	The Sustainable Development Goals (SDGs) are a universal call of action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity.
7.	Give any 2 R's of sustainability.  These are REFUSE, REDUCE, REUSE, RECYCLE. (Any two)
8.	Enlist different problems related to Sustainable Development.  Food and nutrition security, safe drinking water, energy security, and waste management.
9.	Why is upcycling used extensively in sustainable development?  Any product that is not usable can be upcycled with creativity and innovation to give a new look to an old product, this helps in sustainable development.
10.	What is meant by REFUSE in context of creating sustainable environment?  REFUSE implies refusing use of those products which may cause harm to environment.
	DESCRIPTIVE (2 MARKS)
1.	Enumerate any two initiatives through which we can reduce inequalities in our society  <ul style="list-style-type: none"> <li>• Helpful to one another.</li> <li>• Friendly with everyone.</li> <li>• Including everyone while working or playing.</li> <li>• Helping others by including everyone whether they are small or big, girl or boy, belonging to any class or caste.</li> </ul>
2.	Explain 'Affordable and Clean Energy'.  <ul style="list-style-type: none"> <li>• Using solar power i.e., power generated using the sun does not cause pollution as it does not require burning of non-renewable fuels, such as coal.</li> <li>• Use of biogas is also an eco-friendly alternative to natural gas.</li> </ul>
3.	'Reduced Inequalities' is one of the Sustainable development goals set by the UN. Give any two ways to reduce inequalities.  Two easy to reduce inequalities are : -

	<ul style="list-style-type: none"> <li>• Be helpful to one another.</li> <li>• be friendly with everyone</li> </ul>
4.	<p>What are the problems related to sustainable development? Discuss any two.</p> <ul style="list-style-type: none"> <li>• Food: Large areas of rich, fertile land needed to grow crops, which is becoming less as we are using up more and more land for other purposes – cities, roads, airports, industries, etc. Soil nutrients are also getting depleted and lots of chemicals are spoiling the soil due to use of chemical fertilizers.</li> <li>• Water: We use fresh water from rivers and ponds for drinking and cleaning but dump garbage into them. The rivers and ponds are getting polluted. This way after several years, we will have no clean water for our use.</li> <li>• Fuel: We are using a lot of wood from trees as fuels and for construction of homes and furniture. As more and more trees are being cut, it is affecting the climate of the place. Extreme weather conditions, such as floods, extreme cold or heat, are seen in many places, which affect the people living there.</li> </ul>
5.	<p>Briefly explain importance of sustainable development.</p> <ul style="list-style-type: none"> <li>• It will ensure that resources like air, water, forests are saved to future generation.</li> <li>• Problems like Climate Change, Emission of Green House gases can be taken care of with the help of Sustainable Development.</li> <li>• Adoption of Sustainable Development in our daily life and at our work place will also promote economic growth.</li> </ul>

## INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Humans developed machines to make their lives easier to accomplish tasks which are too tedious or are time consuming. Therefore humans put efforts in making the machines more sophisticated and smart.

Children are asked to compare old TV and smart TVs. How they differ in their working.

Similarly Old phones and smartphones are compared, to understand about latest facilities in smart phones.

Mention two types of machines which have evolved with time.

---

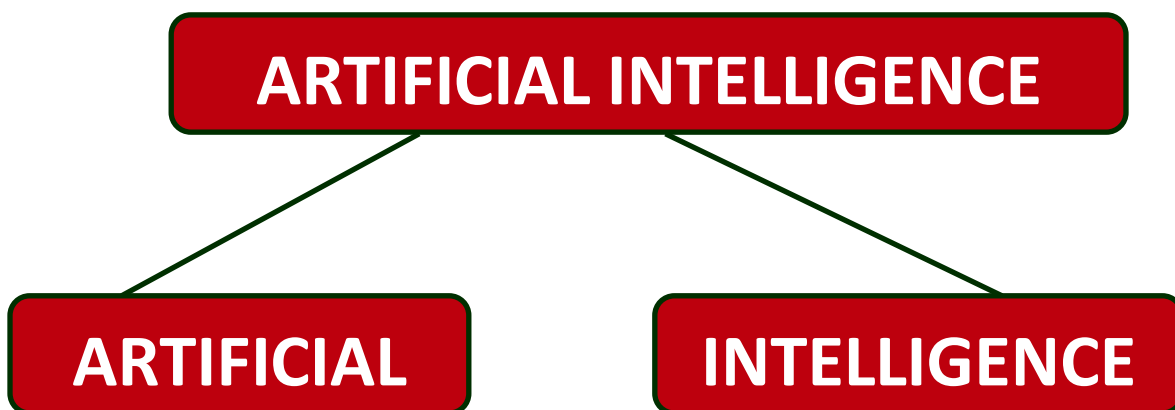
---

---

### **ARTIFICIAL INTELLIGENCE:**

Artificial is something which is man-made, which does not occur naturally.

Intelligence is the *'ability to perceive or infer information, and to retain it as knowledge to be applied towards adaptive behaviours within an environment or context.'*



### **HUMAN INTELLIGENCE:**

Human Intelligence is defined in terms of :

1. Ability to observe, recognize and understand
2. Ability to make 'smart' decisions and solve problems
3. Ability to learn and increase knowledge



Any device that can perform the above, can be termed as intelligent device.

When a machine possesses the ability to mimic human traits i.e make decisions, predict the future, learn and improve on its own by collecting data, understand it, analyse it , learn from it and improve it, it is said to have Artificial Intelligence. Machines become intelligent once they are trained with data and algorithm.

Define Artificial Intelligence.

---



---

How does a machine become Artificially Intelligent?

---



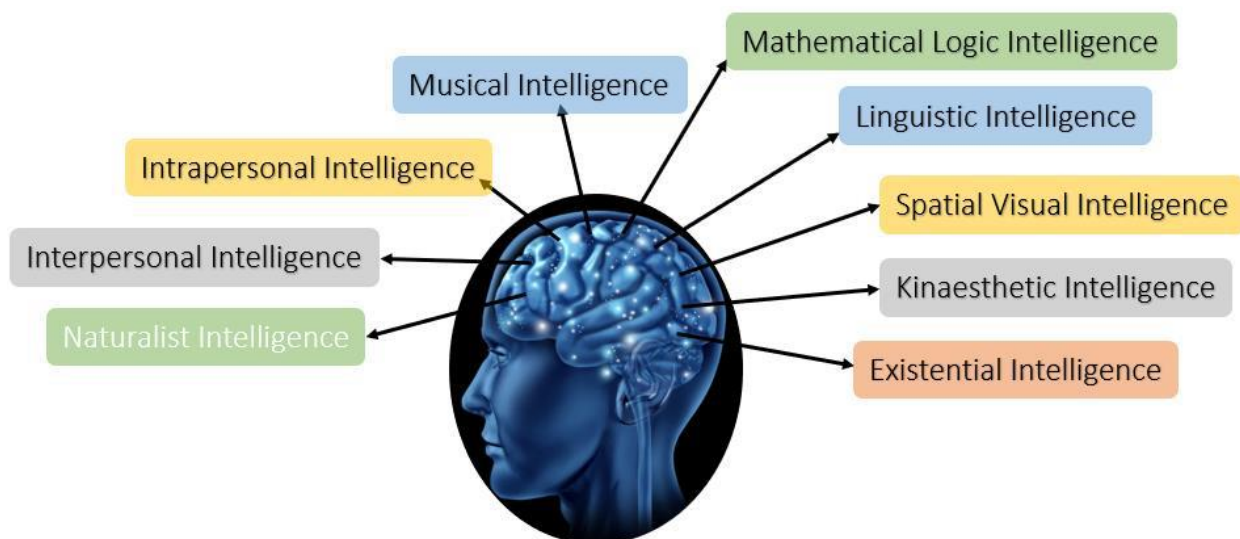
---

Mention four examples of artificially intelligent applications in our smart phones.

**Answer:**

Phone Smart Lock / Snapchat filter / Shopping websites / Netflix / YouTube / Face Detection / Google Maps / Emotions recognition / Google assistant / Natural language recognition / image detection / beauty filters etc.

**THE ABILITIES THAT ARE INVOLVED IN INTELLIGENCE:**



There are mainly 9 types of Intelligence :-

1. **Mathematical Logical Intelligence:** A person's ability to regulate, measure, and understand numerical symbols, abstraction and logic.
2. **Linguistic Intelligence:** Language processing skills both in terms of understanding or implementation in writing or speech.
3. **Spatial Visual Intelligence:** It is defined as the ability to perceive the visual world and the relationship of one object to another.
4. **Kinaesthetic Intelligence:** Ability that is related to how a person uses his limbs in a skilled manner.
5. **Musical Intelligence:** As the name suggests, this intelligence is about a person's ability to recognize and create sounds, rhythms, and sound patterns.
6. **Intrapersonal Intelligence:** Describes the level of self-awareness someone has starting from realizing weakness, strength, to recognizing his own feelings.
7. **Existential Intelligence:** An additional category of intelligence relating to religious and spiritual awareness.
8. **Naturalist Intelligence:** An additional category of intelligence relating to the ability to process information on the environment around us.
9. **Interpersonal Intelligence:** Interpersonal intelligence is the ability to communicate with others by understanding other people's feelings and the influence of the person.

Every human being has all 9 intelligence, but at different levels.

What do you understand by mathematical and logical reasoning?

---

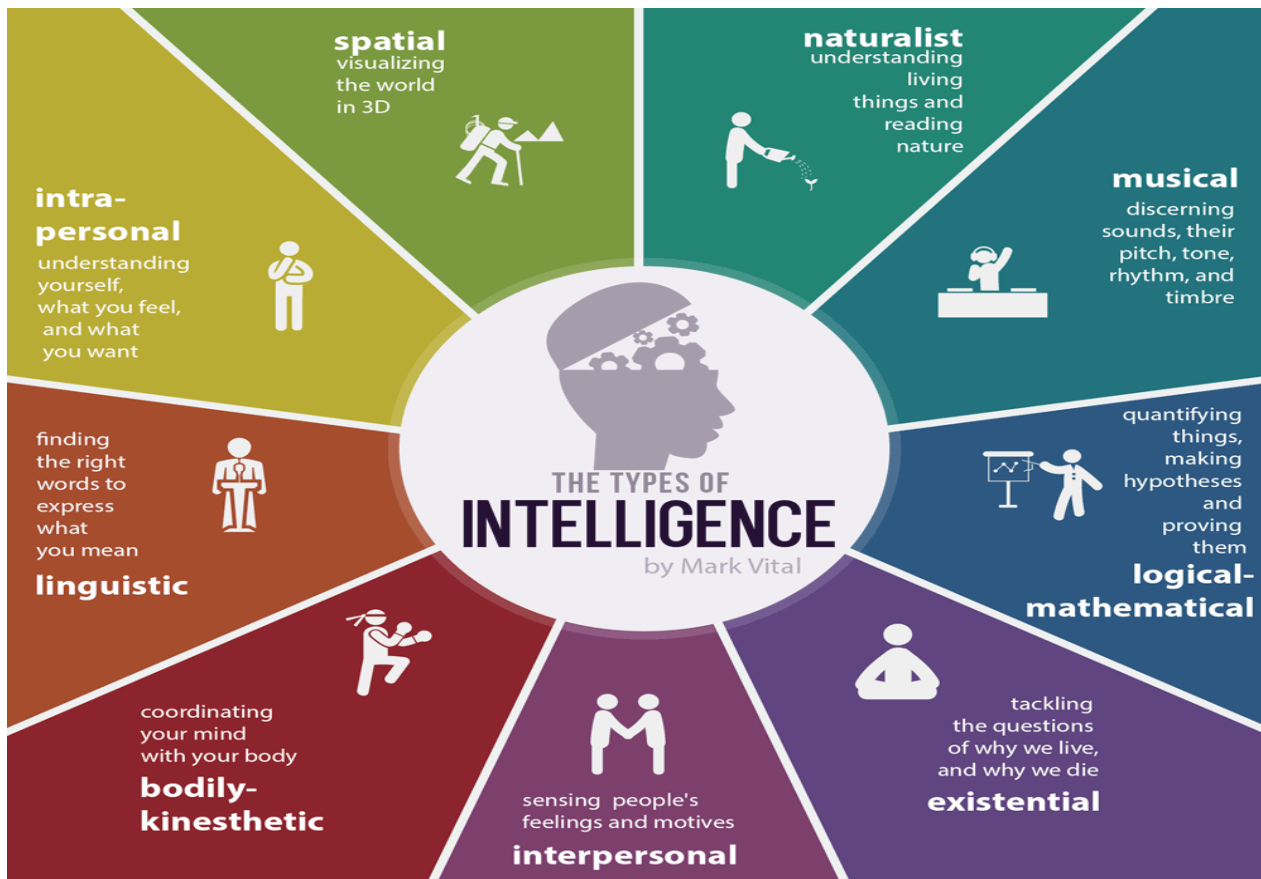
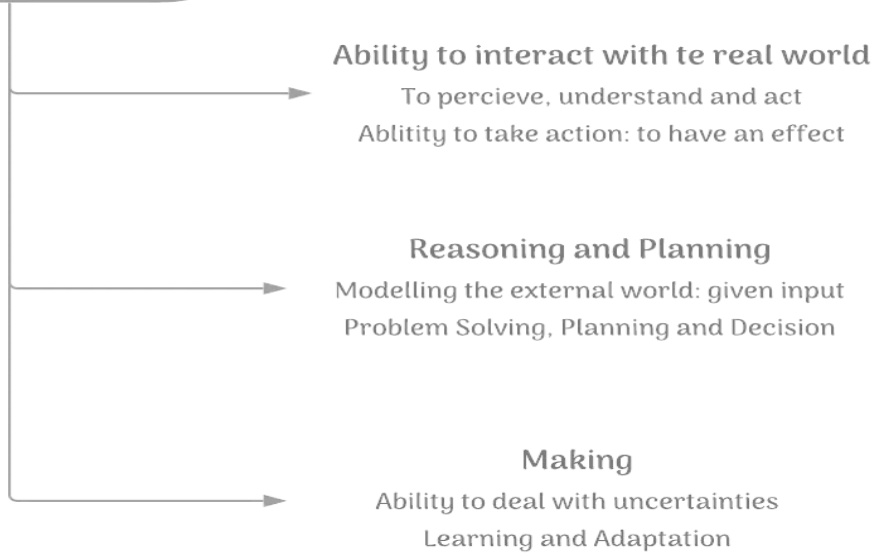


---



---

# INTELLIGENCE



## Exercise – 1 :

Teachers can list out some professions and ask students to identify the type of intelligence used in their professions.

For Eg:

Lawyers : Linguistic Intelligence

Musicians : Musical Intelligence

Architect : Mathematical, Logical Reasoning

**Exercise – 2 :**

Allow students to check on, the type of intelligence used by them, when they are exposed to various scenarios.

---

---

---

Identify and list the intelligence types that you have in descending order.

---

---

---

What is Intelligence? Explain in brief any three types of intelligence that are mainly perceived by human beings?

---

---

---

What do you understand by Interpersonal Intelligence?

---

---

---

**APPLICATION OF ARTIFICIAL INTELLIGENCE AROUND US:**

**a. Google Search Engine:**

With the help of AI, Google Search Engines, turned into intelligent search, producing direct answers. It uses voice and image searches and incorporated deep learning to fasten the searches with more accuracy.

**b. Voice assistant:**

AI is being used in voice assistants to recognize words spoken by the user. NLP has capabilities like “Speech-to-Text” convert the natural language of the user into text for further processing. Digital assistants improve its performance over time.

**c. E-commerce website:**



With the use of big data, AI in E-Commerce is impacting customer choices by recording the data of previous purchases, searched products, and online browsing habits.

**d. Navigate to Places:**

To help us navigate to places, apps like UBER and Google Maps exist. Thus, one no longer needs to stop to ask for directions.

**e. Improved Gaming Experience:**

AI has changed the world of gaming by making the game more intelligent with enhanced graphics, providing the ability to learn using machine learning algorithms. Games, understand human patterns and give responses to new difficulty levels. AI can adapt to your playing style by making the game more exciting.

**f. Platforms that provide recommendations:**

Platforms like Netflix, Amazon, Spotify, YouTube etc. show us recommendations on the basis of what we like. They even cater to needs of connecting with friends on social media platforms with apps like Facebook and Instagram. They also send us customized notifications about our online shopping details, auto-create playlists according to our requests and so on. Taking selfies with Snapchat filters are all possible now.

**g. Monitor Health:**

AI is also being used to monitor our health. Chatbots and other health apps are available, which continuously monitor the physical and mental health of its users.

The humanoids like Sophia, to get citizenship, biometric security systems like the face locks in phones, real-time language translators, weather forecasts, all use AI.

**WHAT IS AI & WHAT IS NOT AI :**

<b>AI Machine</b>	<b>Not AI machine</b>
1. AI machines are trained with data and algorithm.	1. Smart machines which are not AI, do not require training data, they work on algorithms only.
2. AI machines learn from mistakes and experience. They try to improvise on their next iterations.	2. Smart machines work on fixed algorithms and they always work with the same level of efficiency, which is programmed into them.
3. AI machines can analyses the situation and can take decisions accordingly.	3. Machines which are not AI cannot take decisions on their own.
4. AI based drones capture the real-time data during the flight, processes it in real-time, and makes a human-independent decision based on the processed data.	4. An automatic door in a shopping mall, seems to be AI-enabled, but it is built with only sensor technology.

**a. A fully automatic washing machine:**

It can work on its own, but it requires human intervention to select the parameters of washing and to do the necessary preparation for it to function correctly before each wash, which makes it an example of automation, not AI.

**b. An Air Conditioner working remotely :**

An air conditioner can be turned on and off remotely with the help of internet but still needs a human touch. This is an example of Internet of Things (IoT).

**c. Automated Robots :**

Robots which might follow a path or maybe can avoid obstacles but need to be primed accordingly each time.

**d. Automated Projects using Sensors :**

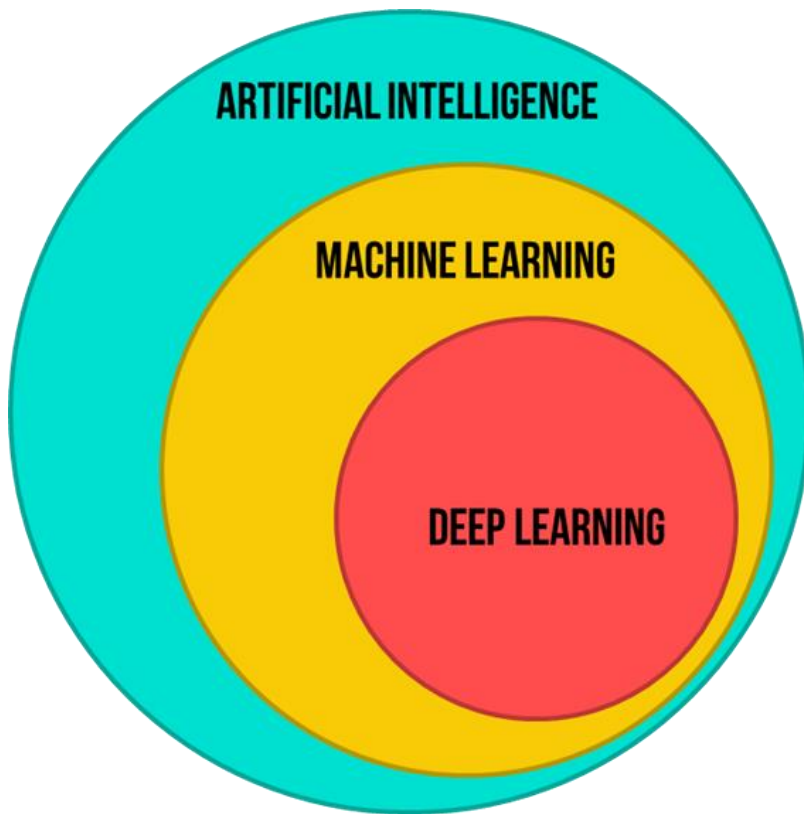
A lot of projects which can automate our surroundings with the help of sensors, bots or the automation machine is not trained with any data, it does not count as AI.

**e. All "smart" devices are not AI-enabled :**

For example, a TV does not become AI-enabled if it is a smart one.

**NOTE: It gets the power of AI when it is able to think and process on its own.**

**AI, ML & DL :**



**Artificial Intelligence (AI)**

Refers to the technique that enables computers to mimic human intelligence. It gives the ability to machines to recognize a human's face; to move and manipulate objects; to understand the voice commands by humans etc. The AI-enabled machines think algorithmically and execute intelligently.

**Machine Learning (ML)**

It is a subset of Artificial Intelligence which enables machines to improve at tasks with experience (data) using the provided data and make accurate Predictions/ Decisions.

**Deep Learning (DL)**

It enables software to train itself to perform tasks with vast amounts of data. In Deep Learning, the machine is trained with huge amounts of data which helps it in training itself around the data. Such machines are intelligent enough to develop algorithms for themselves.

### Differentiate between Machine Learning & Deep Learning.

	Machine Learning	Deep Learning
Data	Performs well on small to medium datasets	Performs well on large datasets
Hardware	Able to function on CPU	Requires significant computing power e.g., GPU
Features	Features need to be manually identified	Learns features automatically
Training time	Quick to train	Computationally intensive

### Compare Artificial Intelligence, Machine Learning & Deep Learning.

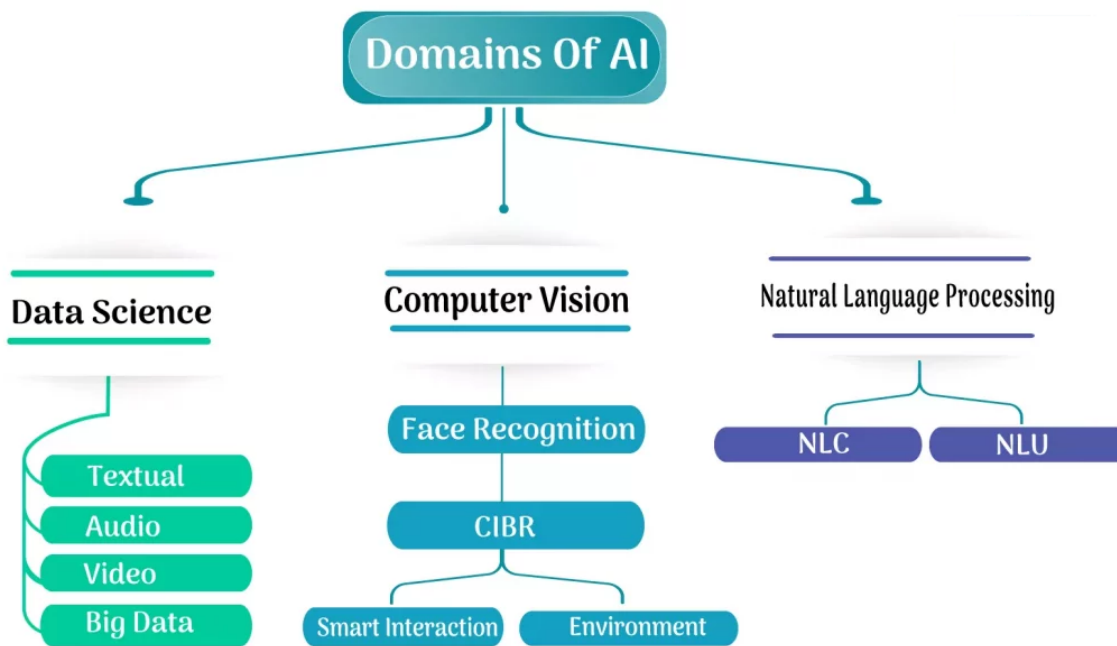
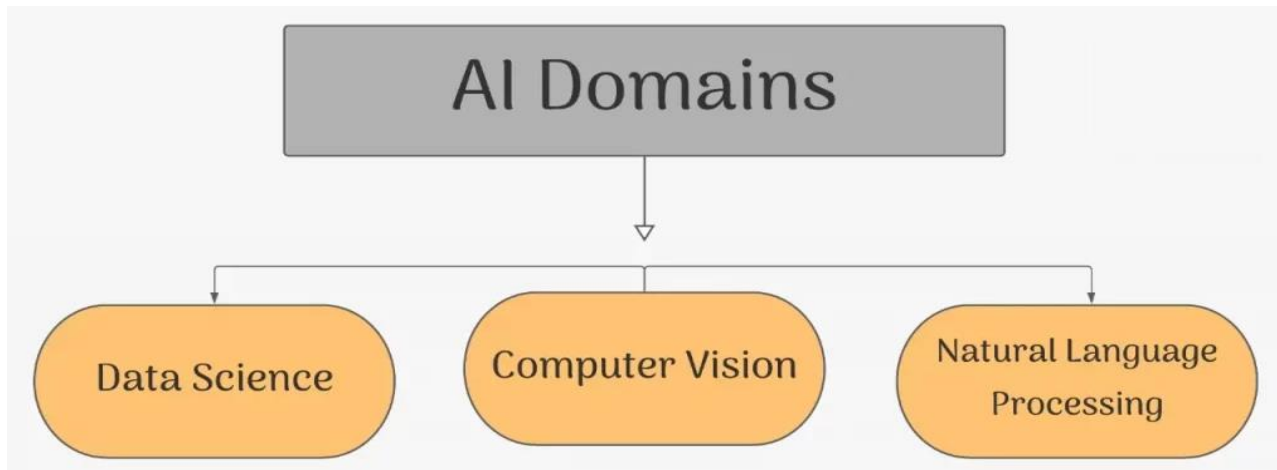
Artificial Intelligence	Machine Learning	Deep Learning
AI stands for Artificial Intelligence, and is basically the study/process which enables machines to mimic human behaviour through particular algorithm.	ML stands for Machine Learning, and is the study that uses statistical methods enabling machines to improve with experience.	DL stands for Deep Learning, and is the study that makes use of Neural Networks (similar to neurons present in human brain) to imitate functionality just like a human brain.
AI is the broader family consisting of ML and DL as it's components.	ML is the subset of AI.	DL is the subset of ML.
AI is a computer algorithm which exhibits intelligence through decision making.	ML is an AI algorithm which allows system to learn from data.	DL is a ML algorithm that uses deep (more than one layer) neural networks to analyze data and provide output accordingly.
Search Trees and much complex math is involved in AI.	If you have a clear idea about the logic (math) involved in behind and you can visualize the complex functionalities like K-Mean, Support Vector Machines, etc., then it defines the ML aspect.	If you are clear about the math involved in it but don't have idea about the features, so you break the complex functionalities into linear/lower dimension features by adding more layers, then it defines the DL aspect.

The aim is to basically increase chances of success and not accuracy.	The aim is to increase accuracy not caring much about the success ratio.	It attains the highest rank in terms of accuracy when it is trained with large amount of data.
Three broad categories/types Of AI are: Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI) and Artificial Super Intelligence (ASI)	Three broad categories/types Of ML are: Supervised Learning, Unsupervised Learning and Reinforcement Learning	DL can be considered as neural networks with a large number of parameters layers lying in one of the four fundamental network architectures: Unsupervised Pre-trained Networks, Convolutional Neural Networks, Recurrent Neural Networks and Recursive Neural Networks
The efficiency Of AI is basically the efficiency provided by ML and DL respectively.	Less efficient than DL as it can't work for longer dimensions or higher amount of data.	More powerful than ML as it can easily work for larger sets of data.
Examples of AI applications include: Google's AI-Powered Predictions, Ridesharing Apps Like Uber and Lyft, Commercial Flights Use an AI Autopilot, etc.	Examples of ML applications include: Virtual Personal Assistants: Siri, Alexa, Google, etc., Email Spam and Malware Filtering.	Examples of DL applications include: Sentiment based news aggregation, Image analysis and caption generation, etc.

## INTRODUCTION TO AI DOMAINS:

Artificial Intelligence becomes intelligent according to the training which it gets. For training, the machine is fed with datasets. According to the applications for which the AI algorithm is being developed, the data which is fed into it changes.

With respect to the type of data fed in the AI model, AI models can be broadly categorized into three domains:



**a. Data Sciences**

Data sciences is a domain of AI related to data systems and processes. The system collects numerous data, maintains data sets, and derives meaning/sense out of them.

The information extracted through data science can be used to make a decision about it.

Example of Data Science:

**Price Comparison Websites**

These websites are being driven by lots of data giving us the convenience of comparing the price of a product from multiple vendors at one place.

PriceGrabber, PriceRunner, Jungle, Shopzilla, DealTime are some examples of price comparison websites.

**b. Computer Vision**

Computer Vision (CV) , is a domain of AI that depicts the capability of a machine to get and analyze visual information and predict some decisions about it. The entire process involves image acquiring, screening, analyzing, identifying and extracting information. This extensive processing helps computers to understand any visual content and act on it accordingly.

In computer vision, Input to machines can be photographs, videos and pictures from thermal or infrared sensors, indicators and different sources.

Computer vision related projects translate digital visual data into descriptions. This data is then turned into computer-readable language to aid the decision-making process. The main objective of this domain of AI is to teach machines to collect information from pixels.

## **Examples of Computer Vision**

### **Self-Driving cars/ Automatic Cars**

CV systems scan live objects and analyse them, based on whether the car decides to keep running or to stop.

### **Face Lock in Smartphones**

Smartphones come with the feature of face locks in which the smartphone's owner can set up his/her face as an unlocking mechanism for it. The front camera detects and captures the face and saves its features during initiation. Next time onwards, whenever the features match, the phone is unlocked.

## **c. Natural Language Processing**

Natural Language Processing (NLP) , is a branch of artificial intelligence that deals with the interaction between computers and humans using the natural language.

*Natural language* refers to language that is spoken and written by people, and natural language processing (NLP) attempts to extract information from the spoken and written word using algorithms.

The ultimate objective of NLP is to read, decipher, understand, and make sense of the human languages in a manner that is valuable.

It has two main components:

**Natural Language Understanding (NLU):** It is used for spoken or written language to provide a link between natural language inputs and what they present. It analyzes different aspects of language.

**Natural Language Generation (NLG):** It helps to produce meaningful phrases and sentences along with Text planning, Sentence Planning, and Text realization.

## **Examples of Natural Language Processing**

### **Email filters**

Email filters are one of the most basic and initial applications of NLP online. It started out with spam filters, uncovering certain words or phrases that signal a spam message.

### **Smart assistants**

Smart assistants like Apple's Siri and Amazon's Alexa recognize patterns in speech, then infer meaning and provide a useful response.

What are AI Domains ?

---

---

Pick the odd one out and justify your answer:

- a. Snap Chat Filter
- b. Face Lock in Phone
- c. Chatbot
- d. Image search Option

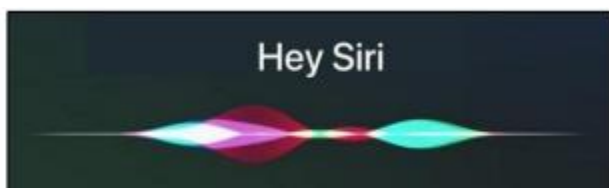
Answer: Chatbot, as it is NLP based, the other three are Computer vision based

### **Applications of Artificial Intelligence around us**

Every now and then, we surf the internet for things on Google without realizing how efficiently Google always responds to us with accurate answers. Not only does it come up with results to our search in a matter of seconds, it also suggests and autocorrects our typed sentences.



We nowadays have pocket assistants that can do a lot of tasks at just one command. Alexa, Google Assistant, Cortana, Siri are some very common examples of the voice assistants which are a major part of our digital devices.



To help us navigate to places, apps like UBER and Google Maps come in there. Thus, one no longer needs to stop repeatedly to ask for directions.



AI has completely enhanced the gaming experience for its users. A lot of games nowadays are backed up with AI which helps in enhancing the graphics, come up with new difficulty levels, encourage gamers, etc.



AI has not only made our lives easier but has also been taking care of our habits, likes, and dislikes. This is why platforms like Netflix, Amazon, Spotify, YouTube etc. show us recommendations on the basis of what we like.

AI is also being used to monitor our health. A lot of chatbots and other health apps are available, which continuously monitor the physical and mental health of its users.

These applications are not limited to smart devices but also vary to humanoids like Sophia, the very first humanoid robot sophisticated enough to get citizenship, biometric security systems like the face locks we have in our phones, real-time language translators, weather forecasts, and whatnot! This list is huge, and this module will go on forever if we keep tabulating them. So, take some time, discuss with a friend and identify more and more AI applications around you!

### **AI Ethics**

AI ethics is a set of values, principles and techniques that employee widely accepted standards of right and wrong to guide moral conduct in the development and use of AI technology.

#### AI Bias and AI Access

Bias means inclination or prejudice for or against one person or group, especially in a way considered to be unfair. When AI programs, tool, and algorithm exhibit any kind of bias, it is called AI bias.

#### AI Access

Since Artificial Intelligence is still a budding technology, not everyone has the opportunity to access it. The people who can afford AI enabled devices make the most of it while others who cannot are left behind. Because of this, a gap has emerged between these two classes of people and it gets widened with the rapid advancement of technology



## AI Project Cycle

### **What is an AI Project Cycle?**

Project Cycle is a step-by-step process to solve problems using proven scientific methods and drawing inferences about them.

Let us take some daily examples as projects, requiring steps to solve the problem.

Creating a birthday card.

1. Checking the factors like budget, etc which will help us decide the next steps and understanding the Project.
2. Acquiring data from different sources like online, with friends etc for Designs and ideas.
3. Making a list of the gathered data.
4. Creating or modelling a card on the basis of the data collected.
5. Showing it to Parents or cousins to let them check it or evaluate it.

### **Components of AI Project Cycle?**

Components of the project cycle are the steps that contribute to completing the Project.

The Components of AI Project Cycle are: -

- ❖ **Problem Scoping** - Understanding the problem
- ❖ **Data Acquisition** - Collecting accurate and reliable data
- ❖ **Data Exploration** - Arranging the data uniformly
- ❖ **Modelling** - Creating Models from the data
- ❖ **Evaluation** - Evaluating the project

### **1. Problem Scoping**

Problem Scoping refers to understanding a problem, finding out various factors which affect the problem, define the goal or aim of the project.

### **Sustainable Development Goals**

Sustainable Development: To Develop for the present without exploiting the resources of the future.

- 17 goals announced by United Nations.
- Aim to achieve them by 2030.
- Pledge taken by all the member nations of the UN.

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity



## 4 W's of Problem Scoping

### 4 Problem Statement Template

**The 4W's of Problem Scoping are Who, What, Where, and Why.**

This W's helps in identifying and understanding the problem in a better and efficient manner.

- ❖ **Who** - "Who" part helps us in comprehending and categorizing who all are affected directly and indirectly with the problem and who are called the Stake Holders.
- ❖ **What** - "What" part helps us in understanding and identifying the nature of the problem and under this block, you also gather evidence to prove that the problem you have selected exists.
- ❖ **Where** - "Where" does the problem arise, situation, context, and location?
- ❖ **Why** - "Why" is the given problem worth solving?

### Problem Statement Template

The Problem Statement Template helps us to summarize all the key points into one single template. So that in the future, whenever there is a need to look back at the basis of the problem, we can take a look at the Problem Statement Template and understand its key elements of it.

Have a look at Problem Statement Template.

The	Stakeholder	Who
Have a problem	Issue/Problem	What
When/While	Context/Situation/Location	Where
Ideal Solution	How the solution will help the stakeholders	Why

## 2. Data Acquisition

The process of collecting accurate and reliable data to work with.

## Two types of Data Sets

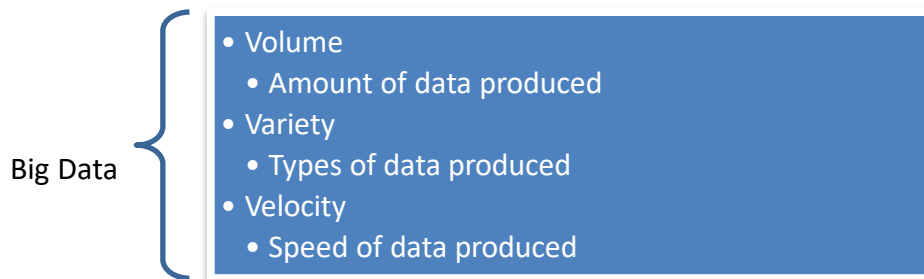
Base	Training set	Testing set
Use	Used for Training the model	Used for Testing the model after it is trained
Size	Is allot bigger than testing data and constitutes about 70% to 80%	It is smaller than Training set and constitutes about 20% to 30%

## Data Features

- Refer to the type of data you want to collect.
- Eg: Salary amount, increment percentage, increment period, bonus etc.

## Big data

- It includes data with sizes that exceed the capacity of traditional software to process within an acceptable time and value.
- The main focus is on unstructured type of data



## ❖ Web Scraping

- Web Scraping means collecting data from web using some technologies.
- We use it for monitoring prices, news and etc.
- Example: Web Scraping using beautiful soup in python.

## ❖ Sensors

- Sensors are very important but very simple to understand.
- Sensors are the part of IoT (Internet of things)
- Sensors collect the physical data and detect the changes.

## ❖ Cameras

- Camera captures the visual information and then that information which is called image is used as a source of data.
- Cameras are used to capture raw visual data.

## ❖ API

- Application Programming interface.
- API is a messenger which takes requests and tells the system about requests and gives the response.
- Ex: Twitter API, Google Search API

## ❖ Observations

- When we observe something carefully, we get some information
- For ex: Scientists Observe creatures to study them.
- Observations are a time-consuming data source.

## ❖ Surveys

- The survey is a method of gathering specific information from a sample of people.
- Example, a census survey for analysing the population

### 3. Data Exploration

In this stage of project cycle, we try to interpret some useful information out of the data we have acquired. For this purpose, we need to explore the data and try to put it uniformly for a better understanding. This stage deals with validating or verification of the collected data and to analyze that:

- The data is according to the specifications decided.
- The data is free from errors.
- The data is meeting our needs

This stage is divided into 2 sub stages.

- 1) Data Cleaning
- 2) Data Visualization.

#### Data Cleaning

Data cleaning helps in getting rid of commonly found errors and mistakes in a data set. These are the 3 commonly found errors in data.

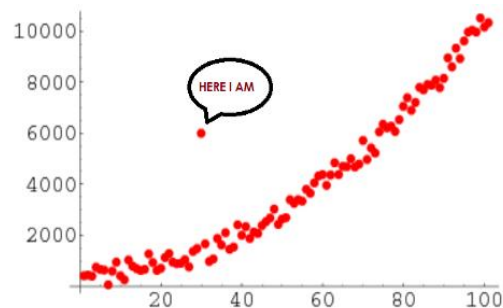
- 1) Outliers: Data points existing out of the range.
- 2) Missing data: Data points missing at certain places.
- 3) Erroneous data: Incorrect data points.

#### Outliers

An outlier is a data point in a dataset that is distant all other observations.

or

An outlier is something that behaves differently the combination/ collection of the data.



from

from

#### Missing Data

What do these NaN values indicate? are the missing values in the data set. can handle them in two ways:

1. By eliminating the rows of missing values. (Generally, not recommended as it might reduce data set to some extent leading to less data to be trained)

using an Imputer to find the best possible substitute to replace missing values.

```
1 data1=pd.read_csv("airquality.csv")
1 data1
```

They We

	Ozone	Solar.R	Wind	Temp	Month	Day
0	41.0	190.0	7.4	67	5	1
1	36.0	118.0	8.0	72	5	2
2	12.0	149.0	12.6	74	5	3
3	18.0	313.0	11.5	62	5	4
4	NaN	NaN	14.3	56	5	5
5	28.0	NaN	14.9	66	5	6

the

2. By

#### Erroneous Data

Erroneous data is test data that falls outside of what is acceptable and should be rejected by the system.

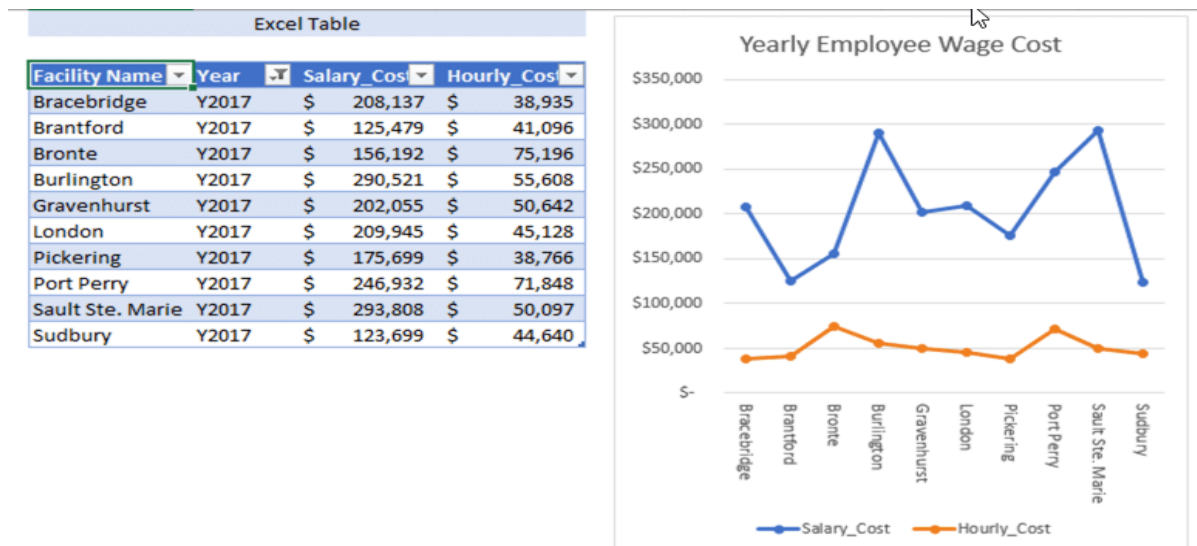
Student Name	Class
RIYA GEORGE	X A
JOSHUA SAM	X A
APARNA BINU	X A
SIDHARDH V R	X A
NITHILA M	57
ATHULYA M S	X A
ANUJA MS	X B
KEERTHI KRISHNANATH	X B

## Data Visualization

Why we need to explore data through visualization?

- 1) We want to quickly get a sense of the trends, relationships, and patterns contained within the data.
- 2) It helps us define strategy for which model to use at a later stage.
- 3) Visual representation is easier to understand and communicate to others.

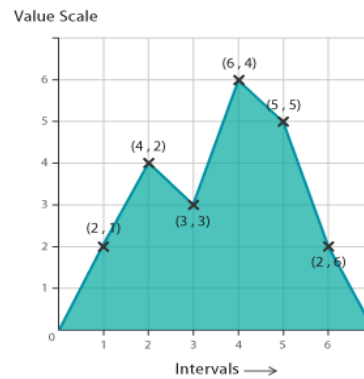
Example:



# Data Visualization Techniques

## 1. Area Graphs

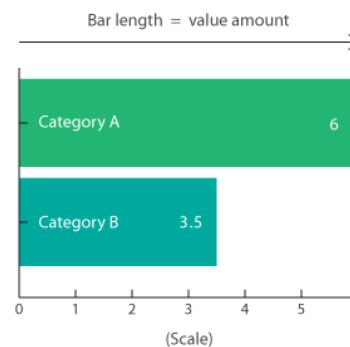
Area Graphs are Line Graphs but with the area below line filled in with a certain colour or texture. Like Line Graphs, Area Graphs are used to display the development of quantitative values over an interval or period. They are most commonly used to show trends, than convey specific values.



the  
time  
rather

## 2. Bar Charts

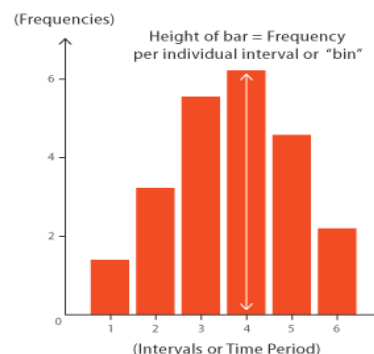
The classic Bar Chart uses either horizontal or vertical (column chart) to show discrete, numerical comparisons across categories. Bars Charts are distinguished from Histograms, as they do not display continuous developments over an interval. Bar Chart's discrete data categorical data and therefore answers the question of "how many?" in each category.



bars  
is  
"how

## 3. Histogram

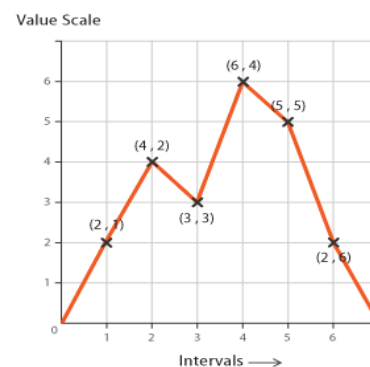
A Histogram visualizes the distribution of data over a continuous interval or certain time period. Each bar in a histogram represents the tabulated frequency at each interval/bin. Histograms help give an estimate as to where values are concentrated, what the extremes are whether there are any gaps or unusual values.



and

## 4. Line Graphs

Line Graphs are used to display quantitative values a continuous interval or time period. A Line Graph is most frequently used to show trends and analyze how the data changed over time. Line Graphs are drawn by first plotting data points on a Cartesian coordinate grid, then connecting a line between all of these points. Typically, y-axis has a quantitative value, while the x-axis is a timescale or a sequence of intervals. Negative values be displayed below the x-axis.

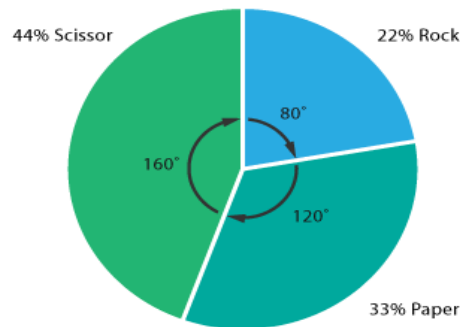


over  
has  
the  
can

## 5. Pie Charts

Pie Charts help show proportions and percentages between categories, by dividing a circle into proportional segments. Each arc length represents a proportion of each category, while the full

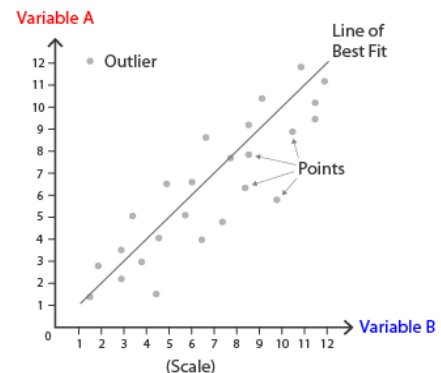
circle represents the total sum of all the data, equal to 100%. Pie Charts are ideal for giving the reader a quick idea of the proportional distribution of the data.



Data			
Rock	Paper	Scissor	TOTAL
2	3	4	9
To calculate percentages			
$2/9=22\%$	$3/9=33\%$	$4/9=44\%$	100%
Degrees for each "pie slice"			
$(2/9) \times 360 = 80^\circ$	$(3/9) \times 360 = 120^\circ$	$(4/9) \times 360 = 160^\circ$	360°

## 6. Scatterplots

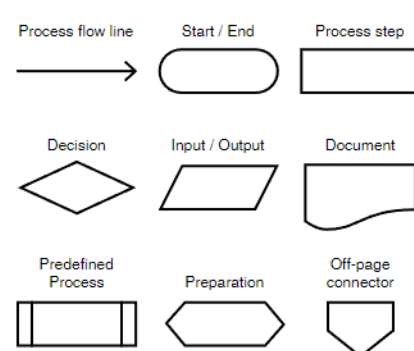
Scatterplots use a collection of points placed using Cartesian Coordinates to display values from two variables. By displaying a variable in each axis, you can if a relationship or correlation between the two variables



detect exists.

## 7. Flow Charts

This type of diagram is used to show the sequential of a process. Flow Charts map out a process using a series of connected symbols, which makes the process to understand and aids in its communication to other people. Flow Charts are useful for explaining how a complex and/or abstract procedure, system, concept or algorithm work. Drawing a Flow Chart can also help in planning and developing a process or improving an existing one.



steps  
easy

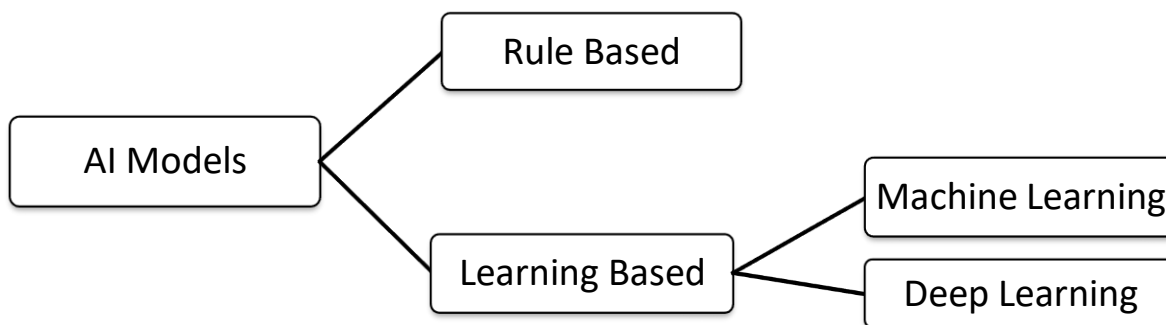
## 4. Modelling

It's the fourth stage of AI project cycle. In previous stage, i.e. graphical representation makes the data understandable for humans as we can discover trends and patterns out of it.

But when it comes to machines accessing and analyzing data, it needs the data in the most basic form of numbers (which is binary – 0s and 1s) and when it comes to discovering patterns and trends in data, the machine goes in for mathematical representations of the same.

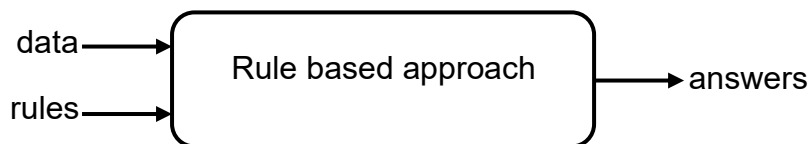
The ability to mathematically describe the relationship between parameters is the heart of every AI model.

Generally, AI models can be classified as follows:



### Rule Based Approach

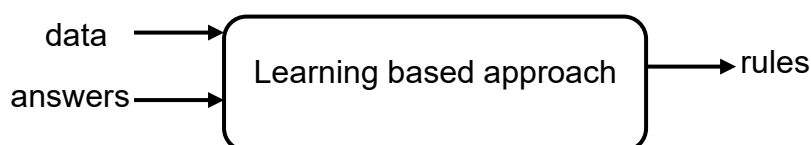
In this approach, the rules are defined by the developer. The machine follows the rules or instructions mentioned by the developer and performs its task accordingly. So, it's a static model. i.e. the machine once trained, does not take into consideration any changes made in the original training dataset.



Thus, machine learning gets introduced as an extension to this as in that case, the machine adapts to change in data and rules and follows the updated path only, while a rule-based model does what it has been taught once.

### Learning Based Approach

It's a type of AI modelling where the machine learns by itself. Under the Learning Based approach, the AI model gets trained on the data fed to it and then is able to design a model which is adaptive to the change in data. That is, if the model is trained with X type of data and the machine designs the algorithm around it, the model would modify itself according to the changes which occur in the data so that all the exceptions are handled in this case.

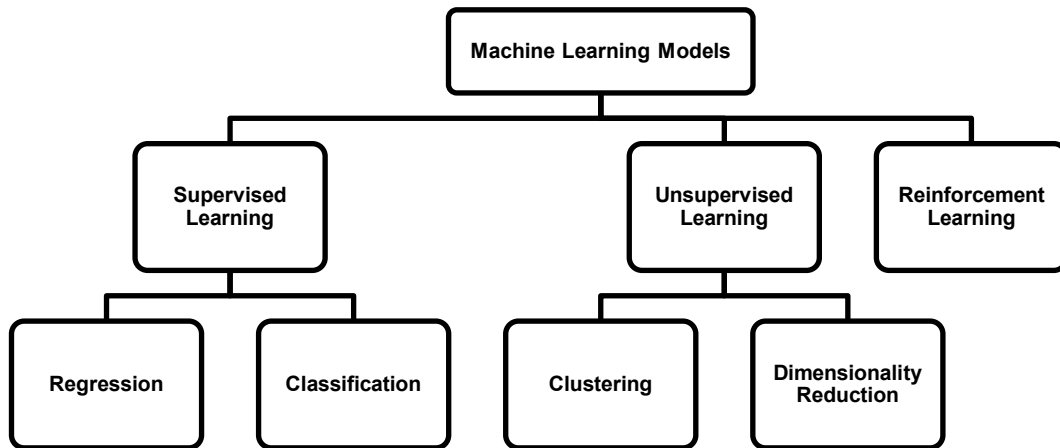




After training, the machine is now fed with testing data. Now, the testing data might not have similar images as the ones on which the model has been trained. So, the model adapts to the features on which it has been trained and accordingly predicts the output.

In this way, the machine learns by itself by adapting to the new data which is flowing in. This is the machine learning approach which introduces the dynamicity in the model.

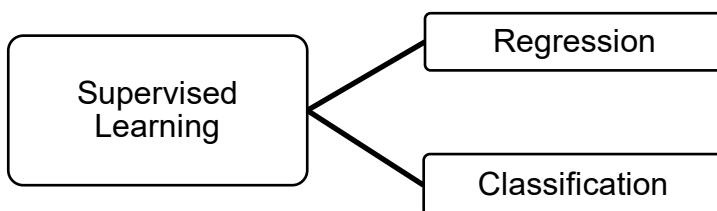
Generally, learning based models can be classified as follows:



## I. Supervised Learning

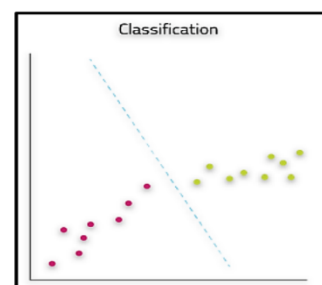
In a supervised learning model, the dataset which is fed to the machine is labelled. In other words, we can say that the dataset is known to the person who is training the machine only then he/she is able to label the data. A label is some information which can be used as a tag for data. For example, students get grades according to the marks they secure in examinations. These grades are labels which categorize the students according to their marks.

There are two main types of supervised learning models:



### a) Classification

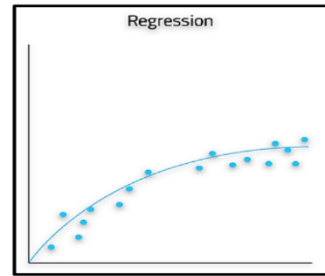
In this model, data is classified according to the labels. example, in the grading system, students are classified on the the grades they obtain with respect to their marks in the examination. This model works on discrete dataset which the data need not be continuous.



For  
basis of  
means

b) Regression

This model work on continuous data. For example, if to predict your next salary, then you would put in the data of previous salary, any increments, etc., and would train the Here, the data which has been fed to the machine is continuous.



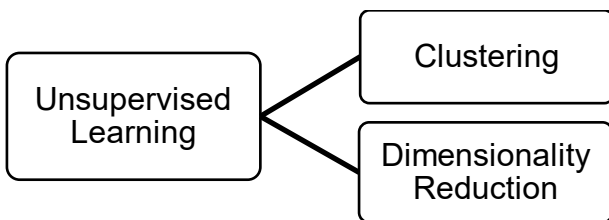
you wish your model.

II. Unsupervised Learning

An unsupervised learning model works on unlabeled dataset. This means that the data which is fed to the machine is random and there is a possibility that the person who is training the model does not have any information regarding it. The unsupervised learning models are used to identify relationships, patterns and trends out of the data which is fed into it. It helps the user in understanding what the data is about and what are the major features identified by the machine in it.

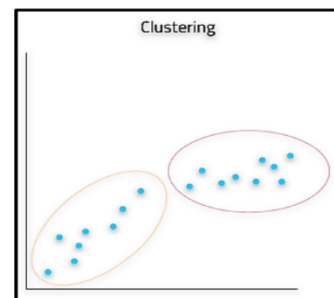
For example, you have a random data of 1000 dog images and you wish to understand some pattern out of it, you would feed this data into the unsupervised learning model and would train the machine on it. After training, the machine would come up with patterns which it was able to identify out of it. The Machine might come up with patterns which are already known to the user like colour or it might even come up with something very unusual like the size of the dogs.

There are two main types of unsupervised learning models:



a) Clustering

It refers to the unsupervised learning algorithm which can the unknown data according to the patterns or trends identified it. The patterns observed might be the ones which are known to developer or it might even come up with some unique patterns it.

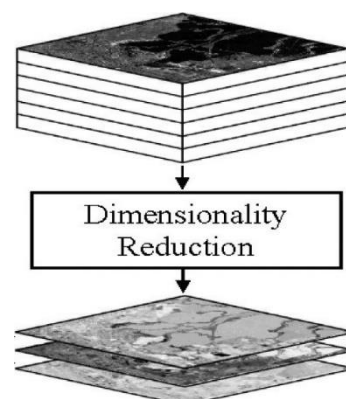


cluster out of the out of

b) Dimensionality Reduction

We humans are able to visualize up to 3-Dimensions but according to a lot of theories and algorithms, there are various entities which exist beyond 3-Dimensions.

For example, in Natural language Processing, the words are considered to be N-Dimensional entities. Which means that we visualize them as they exist beyond our visualization ability. Hence, to make sense out of it, we need to reduce their dimensions. Here, dimensionality reduction algorithm is used.

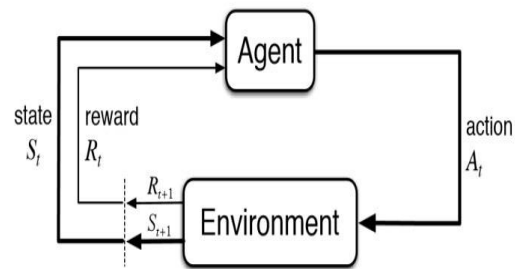


only

cannot

### III. Reinforcement Learning

It is a type of machine learning technique that enables an agent(model) to learn in an interactive environment by trial and error using feedback from its own actions and experiences. Though both supervised and reinforcement learning use mapping between input and output, unlike supervised learning where feedback provided to the agent(model) is a set of actions for performing a task, reinforcement learning uses rewards and punishment as signals for positive and negative behavior. Reinforcement learning is all about making decisions sequentially.



mapping  
learning  
correct

making

### 5. Evaluation

Evaluation is a process of understanding the reliability of any AI model, based on outputs by feeding the test dataset into the model and comparing it with actual answers. i.e. once a model has been made and trained, it needs to go through proper testing so that one can calculate the efficiency and performance of the model. Hence, the model is tested with the help of Testing Data (which was separated out of the acquired dataset at Data Acquisition stage).

The efficiency of the model is calculated on the basis of the parameters mentioned below:



1. Accuracy  
Accuracy is defined as the

percentage of correct predictions out of all the observations.

#### 2. Precision

Precision is defined as the percentage of true positive cases versus all the cases where the prediction is true.

#### 3. Recall

Recall is defined as the fraction of positive cases that are correctly Identified.

#### 4. F1 score

The F1 score is a number between 0 and 1 and is the harmonic mean of precision and recall

## Questions

### 1 mark Questions

- 1) Which of the following is correct about the rule-based approach?
  - a. We cannot provide enough rules to the machine.
  - b. A drawback/feature for this approach is that the learning is static.
  - c. Once the rules are fed into the system, it takes into consideration any changes made in the original training dataset.
  - d. It can improve itself based on the feedbacks.
  
- 2) Choose the five stages of AI project cycle in correct order
  - a. Evaluation -> Problem Scoping -> Data Exploration -> Data Acquisition ->Modelling
  - b. Problem Scoping -> Data Exploration -> Data Acquisition -> Evaluation ->Modelling
  - c. Data Acquisition -> Problem Scoping -> Data Exploration -> Modelling ->Evaluation
  - d. Problem Scoping -> Data Acquisition -> Data Exploration -> Modelling ->Evaluation
  
- 3) A business problem wherein we categorize whether an observation is "Safe," "At Risk," or "Unsafe" is an example of
  - a. Classification
  - b. Clustering
  - c. Regression
  - d. Dimensionality Reduction
  
- 4) **Assertion (A):** We can use histograms when data is in categories (such as "Pop", "Rock", "Jazz", "Hip-Hop" etc.)  
**Reason (R):** We use bar charts when we have continuous data (such as a person's height or weight)
  - a. (A) is false but (R) is true
  - b. (A) is true but (R) is false
  - c. Both (A) and (R) are true
  - d. Both (A) and (R) are false
  
- 5) Choose the correct option
  - a. Unsupervised learning ->labelled dataset, Regression
  - b. Supervised learning -> labelled data set, Regression
  - c. Unsupervised learning ->unlabelled dataset, Classification
  - d. Supervised learning -> unlabelled data set, Regression
  
- 6) Data about the houses such as square footage, number of rooms, features, whether a house has a garden or not, and the prices of these houses, i.e., the corresponding labels are fed into an AI machine. By leveraging data coming from thousands of houses, their features and prices, we can now train the model to predict a new house's price. This is an example of
  - a) Reinforcement learning
  - b) Supervised learning
  - c) Unsupervised learning

d) None of the above

7) \_\_\_\_\_ is defined as the percentage of correct predictions out of all the observations.

- a) Predictions
- b) Accuracy
- c) Reality
- d) F1 Score

8) In \_\_\_\_\_, the machine is trained with huge amounts of data which helps it in training itself around the data.

- a) Supervised Learning
- b) Deep Learning
- c) Classification
- d) Unsupervised Learning

9) What is the role of modelling in an NLP based AI model?

- a) Modelling in NLP helps in processing of AI model
- b) Modelling is required to make an AI model
- c) In NLP, modelling requires data pre-processing only after which the data is fed to the machine.
- d) Modelling is used in simplification of data acquisition

10) Recall-Evaluation method is

- a) defined as the fraction of positive cases that are correctly identified.
- b) defined as the percentage of true positive cases versus all the cases where the prediction is true.
- c) defined as the percentage of correct predictions out of all the observations.
- d) comparison between the prediction and reality

11) Give 2 examples of Supervised Learning models.

- a) Classification and Regression
- b) Clustering and Dimensionality Reduction
- c) Rule Based and Learning Based
- d) Classification and Clustering

12) Define Machine Learning.

- a) Machine learning is the study of computer algorithms that improve automatically through experience.
- b) Refers to any technique that enables computers to mimic human intelligence.

- c) Machine learning refers to computer systems (both machines and software) enables machines to perform tasks for which it is programmed.
- d) Machine Learning refers to projects that allow the machine to work on a particular logic.
- 13) Differentiate between Prediction and Reality.
- a) Prediction is the input given to the machine to receive the expected result of the reality.
- b) Prediction is the output given to match the reality.
- c) The prediction is the output which is given by the machine and the reality is the real scenario in which the prediction has been made.
- d) Prediction and reality both can be used interchangeably.
- 14) Which of the following statements is true for the term Evaluation?
- a) Helps in classifying the type and genre of a document.
- b) It helps in predicting the topic for a corpus.
- c) Helps in understanding the reliability of any AI model
- d) Process to extract the important information out of a corpus.
- 15) Which of the following is not part of the AI Project Cycle?
- a) Data Exploration
- b) Modelling
- c) Testing
- d) Problem Scoping
- 16) \_\_\_\_\_ refers to the AI modelling where the machine learns by itself.
- a) Learning Based
- b) Rule Based
- c) Machine Learning
- d) Data Sciences
- 17) Define the term Machine Learning. Also give 2 applications of Machine Learning in our daily lives.
- 18) Differentiate between Classification and Regression.
- 19) Which of these is NOT used for visualization in AI?
- a) Pie Chart
- b) Scatter plot
- c) Ruler
- d) Bar chart
- 20) Which of the following is an example of rule-based approach?

a) Pixel it activity

b) Decision trees

c) Histogram

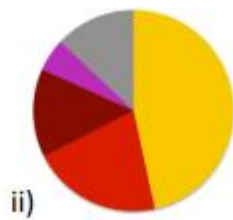
d) Illustration diagram

21) Match the best choice of graph for the data below.

1. Chart to show the number of students in a school over past 5 years.

2. Chart to show the temperature on each day of the week.

3. Chart to show percentage of each sale of ticket type at a concert



a) 1 -> i) ; 2 -> ii) ; 3 -> iii)

b) 1 -> ii) ; 2 -> iii) ; 3 -> i)

c) 1 -> iii) ; 2 -> i) ; 3 -> ii)

d) 1 -> iii) ; 2 -> ii) ; 3 -> i)

22) Name all the stages of an AI Project cycle.

23) What is Testing Dataset?

24) Mention the types of learning approaches for AI modeling

25) What is the objective of evaluation stage?

26) \_\_\_\_\_ is not a learning-based approach where AI model gets trained on the data fed to it and then is able to design a model which is adaptive to the change in data.

**[CBSE TERM-1 2021]**

a) Supervised Learning

b) Unsupervised Learning

c) Reinforcement Learning

d) Enforcement Learning

27) Unsupervised learning is divided into the following two categories. Identify the correct one.

**[CBSE TERM-1 2021]**

a) Rule based and learning based

b) Classification and clustering

c) Clustering and dimensionality reduction

d) Classification and regression

28) \_\_\_\_\_ is one of the types supervised learning model, where data is classified according labels and data need not be continuous.

**[CBSE TERM-1 2021]**

- a) Regression
- b) Clustering
- c) Classification
- d) Dimensionality reduction

29) In \_\_\_\_\_ design is adaptive to change in data, which results in dynamicity of a model.

**[CBSE TERM-1 2021]**

- a) Learning based approach
- b) Rule-based approach
- c) Data Acquisition
- d) Data modelling

30) Drawbacks of Rule based approach is/are:

**[CBSE TERM-1 2021]**

- I. The learning is static
  - II. Any changes made to the original data will not be considered
  - III. Once trained the model cannot improvise on the basis of feedback
- a) All of the above statements are correct
  - b) Statements i and ii are correct
  - c) Statements ii and iii are correct
  - d) Statements i and iii are correct

31) Evaluation is the process of understanding the reliability of any AI model, based on outputs by feeding test dataset into the model and comparing with actual answers.

Therefore, it must be followed by:

**[CBSE TERM-1 2021]**

- a) Problem Scoping
- b) Data Exploration
- c) Data Acquisition
- d) Modelling

32) Classification and regression are \_\_\_\_\_, and approach followed is \_\_\_\_\_

**[CBSE TERM-1 2021]**

- a) Supervised, Learning
- b) Reinforcement, Learning
- c) Unsupervised, Learning
- d) Supervised, rule-based

33) \_\_\_\_\_ refers to the unsupervised learning algorithm which can cluster the unknown data according to the patterns or trends identified out of it.

**[CBSE TERM-1 2021]**

- a) Regression
- e) Clustering
- c) Classification
- d) Dimensionality reduction

34) Accuracy, Recall, Precision, F1 Score are the parameters to calculate the efficiency under \_\_\_\_\_

**[CBSE TERM-1 2021]**

- a) Data Acquisition
- b) Data Testing
- c) Data Evaluation
- d) Data Modelling

35) Assertion(A): The training data should be authentic and relevant to the problem statement scoped.

**[CBSE TERM-1 2021]**

Reason(R): It increases the AI project efficiency.

- a) Both A and R are true, and R is the correct explanation of A.
- b) Both A and R are true, but R is not the correct explanation of A.
- c) A is true but R is false.



d) A is false but R is true.

36) Which type of graphical representation suits best for continuous type of data like monthly exam scores of a student?

## 2 Mark Questions

37) What are the two different approaches for AI modelling? Define them

38) Draw the graphical representation of Classification AI model. Explain in brief.

39) Draw the graphical representation of Regression AI model. Explain in brief

40) Draw the graphical representation of Clustering AI model. Explain in brief.

41) Explain Data Exploration stage

## 3 Mark questions

42) Differentiate between rule-based and learning-based AI modelling approaches.

43) Explain the following:

a. Supervised Learning b. Unsupervised Learning

44) Differentiate between classification and clustering algorithms with the help of suitable examples.

# NATURAL LANGUAGE PROCESSING

## INTRODUCTION

Computers can understand the structured form of data like spreadsheets and the tables in the database, but human languages, texts, and voices form an unstructured category of data, and it gets difficult for the computer to understand it, and there arises the need for Natural Language Processing.

Natural Language Processing, or NLP, is the sub-field of AI that is focused on enabling computers to understand and process human languages. AI is a subfield of Linguistics, Computer Science, Information Engineering, and Artificial Intelligence concerned with the interactions between computers and human (natural) languages, in particular how to program computers to process and analyze large amounts of natural language data.

Solving a complex problem in Machine Learning means building a pipeline. In simple terms, it means breaking a complex problem into a number of small problems, making models for each of them and then integrating these models. A similar thing is done in NLP. We can break down the process of understanding English for a model into a number of small pieces.

A usual interaction between machines and humans using Natural Language Processing could go as follows:

Humans talk to the computer

The computer captures the audio

There is an audio to text conversion

Text data is processed

Data is converted to audio

The computer plays the audio file and responds to humans

## Applications of Natural Language Processing

### 1.Chatbots



Chatbots are a form of artificial intelligence that is programmed to interact with humans in such a way that they sound like humans themselves. Depending on the complexity of the chatbots, they can either just respond to specific keywords or they can even hold full conversations that make it tough to distinguish them from humans. Chatbots are created using Natural Language Processing and Machine Learning, which means that they understand the complexities of the English language and find the actual meaning of the sentence and they also learn from their conversations with humans and become better with time. Chatbots work in two simple steps. First, they identify the meaning of the

question asked and collect all the data from the user that may be required to answer the question. Then they answer the question appropriately.

## 2. Autocomplete in Search Engines

Have you noticed that search engines tend to what you are typing and automatically complete sentences? For example, On typing “game” in you may get further suggestions for “game of thrones”, “game of life” or if you are interested in then “game theory”. All these suggestions are provided using autocomplete that uses Natural Language Processing to guess what you want to ask. Search engines use their enormous data sets to analyze what their customers are probably typing when they enter particular words and suggest the most common possibilities. They use Natural Language Processing to make sense of these words and how they are interconnected to form different sentences.



guess  
your  
Google,  
maths

## 3. Voice Assistants

These days voice assistants are all the rage! Whether its Siri, Alexa, or Google Assistant, almost everyone uses one of these to make calls, place reminders, schedule meetings, set alarms, surf the internet, etc. These voice assistants have made life much easier. But how do they work? They use a complex combination of speech recognition, natural language understanding, and natural language processing to understand what humans are saying and then act on it. The long term goal of voice assistants is to become a bridge between humans and the internet and provide all manner of services based on just voice interaction. However, they are still a little far from that goal seeing as Siri still can't understand what you are saying sometimes!



## 4. Language Translator

Want to translate a text from English to Hindi but don't know Hindi? Well, Google Translate is the tool for you! While it's not exactly 100% accurate, it is still a great tool to convert text from one language to another. Google Translate and other translation tools as well as use Sequence to sequence modeling that is a technique in Natural Language Processing. It allows the algorithm to convert a sequence of words from one language to another which is translation. Earlier, language translators used Statistical machine translation (SMT) which meant they analyzed millions of documents that were already translated from one language to another (English to Hindi in this case) and then looked for the common patterns and basic vocabulary of the language. However, this method was not that accurate as compared to Sequence to sequence modeling.



## 5.Sentiment Analysis

Almost all the world is on social media these days! And companies can use sentiment analysis to understand particular type of user feels about a particular topic, etc. They can use natural language processing, computational linguistics, text analysis, etc. to understand the general sentiment of the users for their products and services and find out if the sentiment is bad, or neutral. Companies can use sentiment analysis in a lot of ways such as to find out the emotions of their target audience, to understand product reviews, to gauge their brand sentiment, etc. And not just private companies, even governments use sentiment analysis to find popular opinion and also catch out any threats to the security of the nation.



how a product,

good,

## 6.Grammar Checkers

Grammar and spelling is a very important factor while writing professional reports for your superiors and even assignments for your lecturers. After all, having major errors may get you fired or failed! That's why grammar and spell checkers are a very important tool for any professional writer. They can not only correct grammar and check spellings but also suggest better synonyms and improve the overall readability of your content. And guess what, they utilize natural language processing to provide the best possible piece of writing! The NLP algorithm is trained on millions of sentences to understand the correct format. That is why it can suggest the correct verb tense, a better synonym, or a clearer sentence structure than what you have written. Some of the most popular grammar checkers that use NLP include Grammarly, WhiteSmoke, ProWritingAid, etc.

### Grammar Check



## 7.Email Classification and Filtering

Emails are still the most important method for professional communication. However, all of us still get thousands of promotional Emails that we don't want. Thankfully, our emails are automatically divided into 3 sections Primary, Social, and Promotions which means we never have to the Promotional section! But how does this work? Email services use natural language processing to identify the contents of each Email classification so that it can be put in the correct section. This is not perfect since there are still some Promotional newsletters in Primary, but it's better than nothing. In more advanced cases, some companies also use specialty anti-virus software with natural language processing to scan the Emails and see if there are any patterns and phrases that may indicate a phishing attempt on the employees.



to read. namely, open use with text method

## 8. Text Summarization

Text summarization is the process of creating a shorter version of the text with only vital information and thus, helps the user to understand the text in a shorter amount of time. The main advantage of text summarization lies in the fact that it reduces user's time in searching the important details in the document.

There are two main approaches to summarizing text documents –

1. **Extractive Method:** It involves selecting phrases and sentences from the original text and including it in the final summary.

**Example:**

**Original Text:** *Python is a high-level, interpreted, interactive, and object-oriented scripting language. Python is a great language for the beginner-level programmers.*

**Extractive Summary:** *Python is a high-level scripting language is great language for beginner-level programmers.*

2. **Abstractive Method:** The Abstractive method involves generating entirely new phrases and sentences to capture the meaning of source document.

**Example:**

**Original Text:** *Python is a high-level, interpreted, interactive, and object-oriented scripting language. Python is a great language for the beginner-level programmers*

**Abstractive Summary:** *Python is interpreted and interactive language and it is easy to learn.*

### 1. Text Classification

Texts are a form of unstructured information that possesses very prosperous records inside them. Text Classifiers categorize and arrange exceptionally a great deal with any form of textual content that we use currently. Text classification makes it possible to assign predefined categories to a document and organize it to help you find the information you need or simplify some activities. For example, an application of text categorization is spam filtering in email. A very fundamental key and remarks for commercial enterprise would be how their merchandise is touching their meant buyers and Text Classification offers solutions to enterprise questions with the aid of classifying people's opinions on the stated brand, price, and aspects.

## Questions




- 1 What do you mean by Natural language processing
- 2 Name the AI game which uses NLP
- 3 Write an example of text classification
- 4 Which application of NLP assigns predefined categories to a document and organize it to help customer to find the information they want

5 I used to identify opinions online to help what customers think about the products and services. Who am I?

## **INTRODUCTION TO CHATBOTS**

Chatbots is a computer program designed to simulate conversation with human users, especially over the internet powered by Artificial intelligence.

Eg:

	<p><b>Mitsuku Bot</b></p> <p><a href="https://www.pandorabots.com/mitsuku/">https://www.pandorabots.com/mitsuku/</a></p>
	<p>AskDISHA 2.0 (Digital Interaction To Seek Help Anytime) is an <b>Artificial Intelligence and Machine learning based Chatbot</b>, that answers queries pertaining to various services offered by IRCTC and even help users perform various transactions like end to end ticket booking, and more.</p>
	<ul style="list-style-type: none"> <li>• CleverBot*</li> </ul> <p><a href="https://www.cleverbot.com/">https://www.cleverbot.com/</a></p>
	<ul style="list-style-type: none"> <li>• Jabberwacky*</li> </ul> <p><a href="http://www.jabberwacky.com/">http://www.jabberwacky.com/</a></p>
	<ul style="list-style-type: none"> <li>• Haptik*</li> </ul> <p><a href="https://haptik.ai/contact-us">https://haptik.ai/contact-us</a></p>
	<ul style="list-style-type: none"> <li>• Rose*</li> </ul> <p><a href="http://ec2-54-215-197-164.us-west-1.compute.amazonaws.com/speech.php">http://ec2-54-215-197-164.us-west-1.compute.amazonaws.com/speech.php</a></p>
	<ul style="list-style-type: none"> <li>• Ochatbot*</li> </ul> <p><a href="https://www.ometrics.com/blog/list-of-fun-chatbots/">https://www.ometrics.com/blog/list-of-fun-chatbots/</a></p>

## Types of Chatbots

1. Simple Chatbot (Script bots)
2. Smart Chatbots (AI based Smart bots)

Script Bot	Smart Bot
<ol style="list-style-type: none"> <li>1. Script bots are easy to make</li> <li>2. Script bots work around a script that is programmed in them ie. Rule based chatbot</li> <li>3. Mostly they are free and are easy to integrate into a messaging platform</li> <li>4. No or little language processing skills</li> <li>5. Task based rules</li> <li>6. Limited functionality</li> <li>7. <b>Example:</b> the bots which are deployed in the customer care section of various companies</li> </ol>	<ol style="list-style-type: none"> <li>1. Smart bots are flexible and powerful</li> <li>2. Smart bots work on bigger databases and other resources directly.</li> <li>3. Smart bots learn with more data</li> <li>4. Coding is required to take this up on board. Works on AI algorithms</li> <li>5. Context based AI</li> <li>6. Wide functionality</li> <li>7. <b>Example:</b> Google Assistant, Alexa, Cortana, Siri, etc.</li> </ol>

## HUMAN LANGUAGE VS COMPUTER LANGUAGE

Human Language	Computer Language
<ol style="list-style-type: none"> <li>1. Our brain keeps on processing the sounds that it hears around itself and tries to make sense of them all the time. <ul style="list-style-type: none"> <li>• <b>Example:</b> In the classroom, as the teacher delivers the session, our brain is continuously processing everything and storing it someplace. Also, while this is happening, when your friend whispers something, the focus of your brain automatically shifts from the teacher's speech to your friend's conversation.</li> <li>• So now, the brain is processing both the sounds but is prioritizing the one on which our interest lies.</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Computers understand the language of numbers. Everything that is sent to the machine has to be converted to numbers. <ul style="list-style-type: none"> <li>• Binary code is a system by which numbers, letters and other information are represented using only two symbols, or binary digits. The binary definition to a computer is a 1s and 0s code arranged in ways that the computer can read, understand, and act upon</li> </ul> </li> </ol>
<ol style="list-style-type: none"> <li>2. The sound reaches the brain through a long channel. As a person speaks, the sound travels from his mouth and goes to the</li> </ol>	<ol style="list-style-type: none"> <li>2. While typing, if a single mistake is made, the computer throws an error and does not process that</li> </ol>



listener's eardrum. The sound striking the eardrum is converted into neuron impulses, gets transported to the brain, and then gets processed.	part. The communications made by the machines are very basic and simple.
3. After processing the signal, the brain gains an understanding of its meaning of it. If it is clear, the signal gets stored. Otherwise, the listener asks for clarity from the speaker. <b>This is how human languages are processed by humans.</b>	3. Now, if we want the machine to understand our language, how should this happen? What are the possible difficulties a machine would face in processing natural language? Let us take a look at some of them here:

- There are rules in human language. There are nouns, verbs, adverbs, and adjectives. A word can be a noun at one time and an adjective some other time. There are rules to provide structure to a language.
- Besides the matter of arrangement, there's also meaning behind the language we use. Human communication is complex. There are multiple characteristics of the human language that might be easy for a human to understand but extremely difficult for a computer to understand.

Let's understand Semantics and Syntax with some examples:

1. Different syntax, same semantics:  $2+3 = 3+2$ 
  - Here the way these statements are written is different, but their meanings are the same that is 5.
2. Different semantics, same syntax:  $2/3$  (Python 2.7)  $\neq$   $2/3$  (Python 3)
  - Here the statements written have the same syntax but their meanings are different. In Python 2.7, this statement would result in 1 while in Python 3, it would give an output of 1.5.

## Multiple Meanings of a word

To understand let us have an example of the following three sentences:

1. His **face turned red** after he found out that he had taken the wrong bag
  - What does this mean? Is he feeling **ashamed** because he took another person's bag instead of his? Is he feeling **angry** because he did not manage to steal the bag that he has been targeting?
2. The **red car zoomed past his nose**
  - Probably talking about the **colour of the car**, that travelled close to him in a flash.
3. His **face turns red** after consuming the **medicine**
  - Is he having an **allergic reaction**? Or is he **not able to bear the taste** of that medicine?

## Perfect Syntax, no Meaning



Sometimes, a statement can have a perfectly correct syntax but it does not mean anything. For example

Chickens feed extravagantly while the moon drinks tea.

### Sample Questions

- |  |   |
|--|---|
| 1. Which of these chatbots is/are not AI based                           | 1 |
| a) Script bot      b) Smart bot      c) Hybrid bot      d) None of these |   |
| 2 Give one example of Script bot   | 1 |
| 3 Give 4 examples for Smart Bot  | 2 |
| 4 Distinguish between the Smartbot and Script bot                        | 4 |

### Answers

- 1 A) Script bot
- 2 AskDISHA 2.0
- 3 Google Assistant, Alexa, Cortana, Siri,
- 4 Answer in the notes.

### Activity

1. List some statements with syntax and same semantics and vice-versa.
2. Enact the Smartbot in the class. Incorporate the communication skills.

### Text processing/Data processing, Bag of words, TFIDF, NLTK

Computers can't yet truly understand English in the way that humans do. With AI and NLP, they are learning it fast and already doing a lot. Computers with the help of NLP techniques try to reach to the meaning of the sentences and take action or respond accordingly.

Since we all know that the language of computers is Numerical, the very first step that comes to our mind is to convert our language to numbers. This conversion takes a few steps to happen. The first step to it is Text Normalisation. Since human languages are complex, we need to first of all simplify them in order to make sure that the understanding becomes possible. Text Normalisation helps in cleaning up the textual data in such a way that it comes down to a level where its complexity is lower than the actual data.

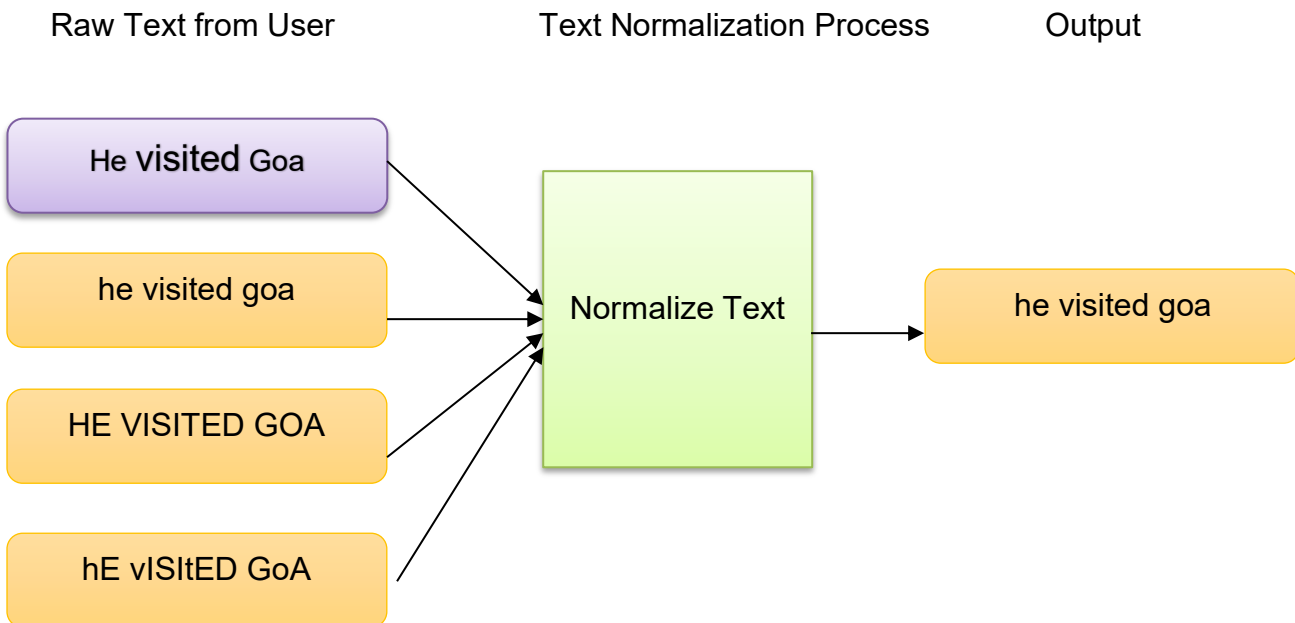
Let us go through Text Normalisation in detail.

## Text Normalisation

Text Normalisation is a process to reduce the variations in text's word forms to a common form when the variation means the same thing.

Text normalisation simplifies the text for further processing

## Text Normalisation



In Text Normalisation, we undergo several steps to normalise the text to a lower level. Before we begin, we need to understand that in this section, we will be working on a collection of written text. That is, we will be working on text from multiple documents and the term used for the whole textual data from all the documents altogether is known as corpus. Not only would we go through all the steps of Text Normalisation, we would also work them out on a corpus. Let us take a look at the steps:

### 1. Sentence Segmentation

Under sentence segmentation, the whole text is divided into individual sentences.

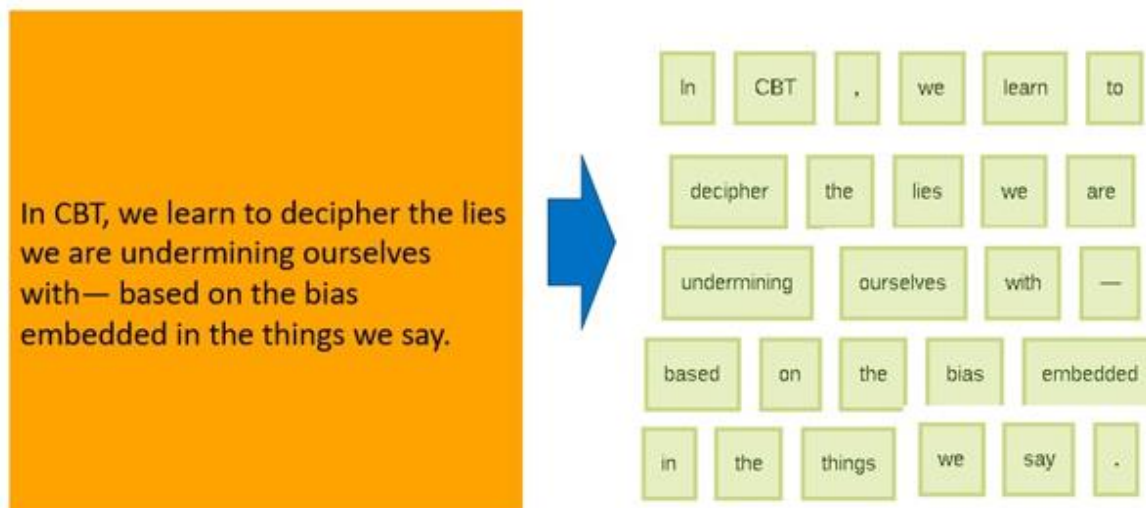
Eg

Hello world. AI is fun to know. It has started impacting our lives in many ways. Many more revolutionary technologies will soon evolve out of it.

- Hello world.
- AI is fun to know.
- It has started impacting our lives in many ways.
- Many more revolutionary technologies will soon evolve out of it.

## 2. Tokenisation

After segmenting the sentences, each sentence is then further divided into tokens. Tokens is a term used for any word or number or special character occurring in a sentence. Under tokenisation, every word, number and special character is considered separately and each of them is now a separate token.

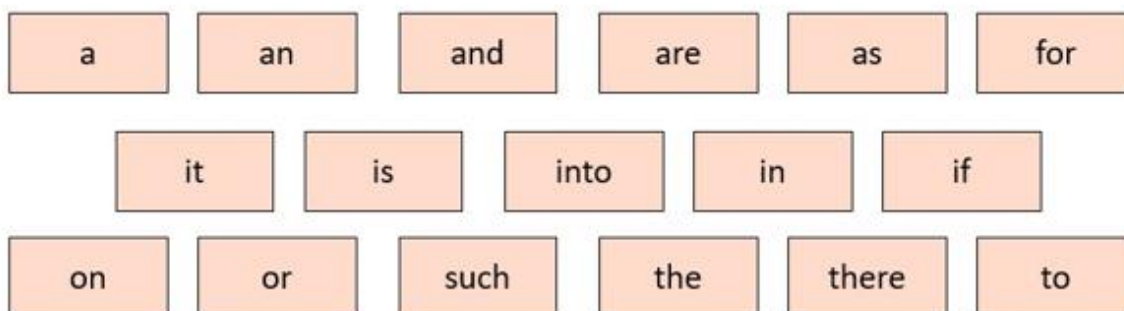


## 3. Removing Stop words, Special characters and Numbers

In this step, the tokens which are not necessary are removed from the token list. What can be the possible words which we might not require?

Stop words are the words in any language which do not add much meaning to a sentence. They can safely be ignored without sacrificing the meaning of the sentence

Humans use grammar to make their sentences meaningful for the other person to understand. But grammatical words do not add any essence to the information which is to be transmitted through the statement hence they come under stop words. Some examples of stop words are:



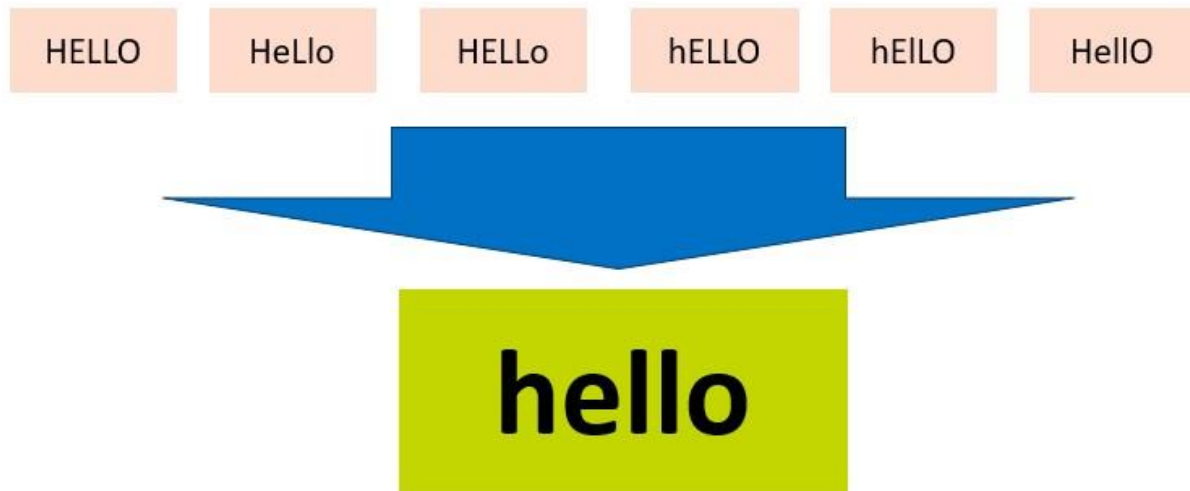
These words occur the most in any given sentence but talk very little or nothing about the context or the meaning of it. Hence, to make it easier for the computer to focus on meaningful terms, these words are removed.

Along with these words, the sentence might have special characters and/or numbers. Now it depends on the type of sentence in the documents that we are working on whether we should keep them in it or not. For example, if you are working on a document containing email IDs, then you

might not want to remove the special characters and numbers whereas in some other textual data if these characters do not make sense, then you can remove them along with the stop words.

#### 4. Converting text to a common case

After the stop words removal, we convert the whole text into a similar case, preferably lower case. This ensures that the case-sensitivity of the machine does not consider same words as different just because of different cases.



Here in this example, the all the 6 forms of hello would be converted to lower case and hence would be treated as the same word by the machine.

#### 5. Stemming

In this step, the remaining words are reduced to their root words. In other words, stemming is the process in which the affixes of words are removed and the words are converted to their base form.

Word	Affixes	Stem
healed	-ed	heal
healing	-ing	heal
healer	-er	heal
studies	-es	studi
studying	-ing	study

Note that in stemming, the stemmed words (words which are we get after removing the affixes) might not be meaningful. Here in this example as you can see: healed, healing and healer all were reduced to heal but studies was reduced to studi after the affix removal which is not a meaningful word. Stemming does not take into account if the stemmed word is meaningful or not. It just removes the affixes hence it is faster.

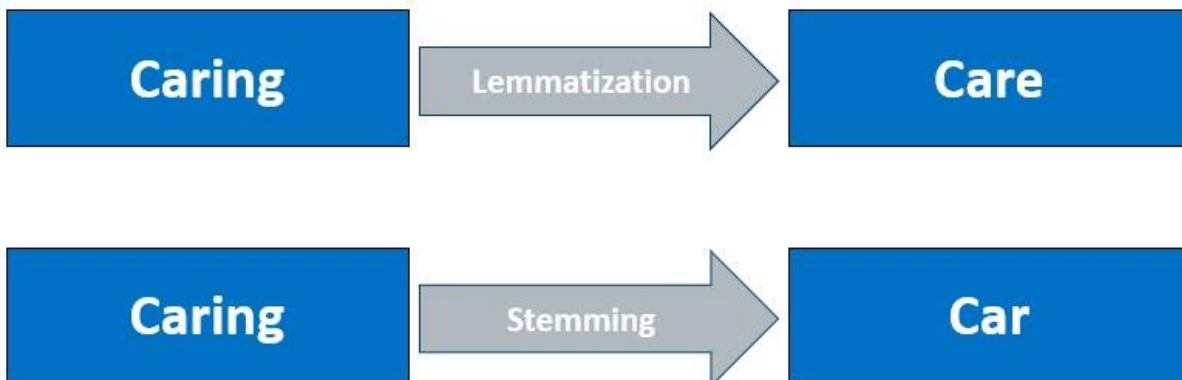
## 6. Lemmatization

Stemming and lemmatization both are alternative processes to each other as the role of both the processes is same – removal of affixes. But the difference between both of them is that in lemmatization, the word we get after affix removal (also known as lemma) is a meaningful one. Lemmatization makes sure that lemma is a word with meaning and hence it takes a longer time to execute than stemming.

Word	Affixes	lemma
healed	- <u>ed</u>	heal
healing	-ing	heal
healer	-er	heal
studies	-es	<b>study</b>
studying	-ing	study

As you can see in the same example, the output for studies after affix removal has become study instead of studi.

Difference between stemming and lemmatization can be summarized by this example:



With this we have normalised our text to tokens which are the simplest form of words. Now it is time to convert the tokens into numbers. For this, we would use the Bag of Words algorithm

### Bag of words (BOW)

Bag of Words is a Natural Language Processing model which helps in extracting features out of the text which can be helpful in machine learning algorithms. In bag of words, we get the occurrences of each word and construct the vocabulary for the corpus.

I love this movie! It's sweet, but with satirical humor. The dialogue is great and the adventure scenes are fun... It manages to be whimsical and romantic while laughing at the conventions of the fairy tale genre. I would recommend it to just about anyone. I've seen it several times, and I'm always happy to see it again whenever I have a friend who hasn't seen it yet!



it	6
I	5
the	4
to	3
and	3
seen	2
yet	1
would	1
whimsical	1
times	1
sweet	1
satirical	1
adventure	1
genre	1
fairy	1
humor	1
have	1
great	1
...	...

This image gives us a brief overview about how bag of words works. Let us assume that the text on the left in this image is the normalised corpus which we have got after going through all the steps of text processing. Now, as we put this text into the bag of words algorithm, the algorithm returns to us the unique words out of the corpus and their occurrences in it. As you can see at the right, it shows us a list of words appearing in the corpus and the numbers corresponding to it shows how many times the word has occurred in the text body. Thus, we can say that the bag of words gives us two things:

1. A vocabulary of words for the corpus
2. The frequency of these words (number of times it has occurred in the whole corpus).

Here calling this algorithm “bag” of words symbolises that the sequence of sentences or tokens does not matter in this case as all we need are the unique words and their frequency in it.

Here is the step-by-step approach to implement bag of words algorithm:

1. Text Normalisation: Collect data and pre-process it
2. Create Dictionary: Make a list of all the unique words occurring in the corpus. (Vocabulary)
3. Create document vectors: For each document in the corpus, find out how many times the word from the unique list of words has occurred.
4. Create document vectors for all the documents. Let us go through all the steps with an example:

**Step 1:** Collecting data and pre-processing it.

Document 1: *Aman and Anil are stressed*

Document 2: *Aman went to a therapist*

Document 3: *Anil went to download a health chatbot*

Here are three documents having one sentence each. After text normalisation, the text becomes:

Document 1: [aman, and, anil, are, stressed]

Document 2: [aman, went, to, a, therapist]

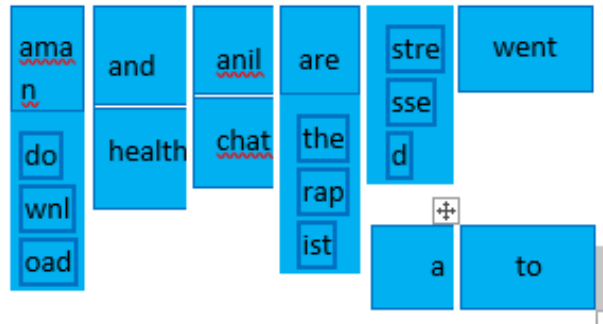
Document 3: [anil, went, to, download, a, health, chatbot]

Note that no tokens have been removed in the stopwords removal step. It is because we have very little data and since the frequency of all the words is almost the same, no word can be said to have lesser value than the other.

### Step 2: Create Dictionary

Go through all the steps and create a dictionary i.e., list down all the words which occur in all three documents:

Dictionary:



Note that even though some words are repeated in different documents, they are all written just once as while creating the dictionary, we create the list of unique words.

### Step 3: Create document vector

In this step, the vocabulary is written in the top row. Now, for each word in the document, if it matches with the vocabulary, put a 1 under it. If the same word appears again, increment the previous value by 1. And if the word does not occur in that document, put a 0 under it.

aman	and	anil	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0

Since in the first document, we have words: aman, and, anil, are, stressed. So, all these words get a value of 1 and rest of the words get a 0 value.

### Step 4: Repeat for all documents

Same exercise has to be done for all the documents. Hence, the table becomes:



aman	and	anil	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0
1	0	0	0	0	1	1	1	1	0	0	0
0	0	1	0	0	1	1	1	0	1	1	1

In this table, the header row contains the vocabulary of the corpus and three rows correspond to three different documents. Take a look at this table and analyse the positioning of 0s and 1s in it.

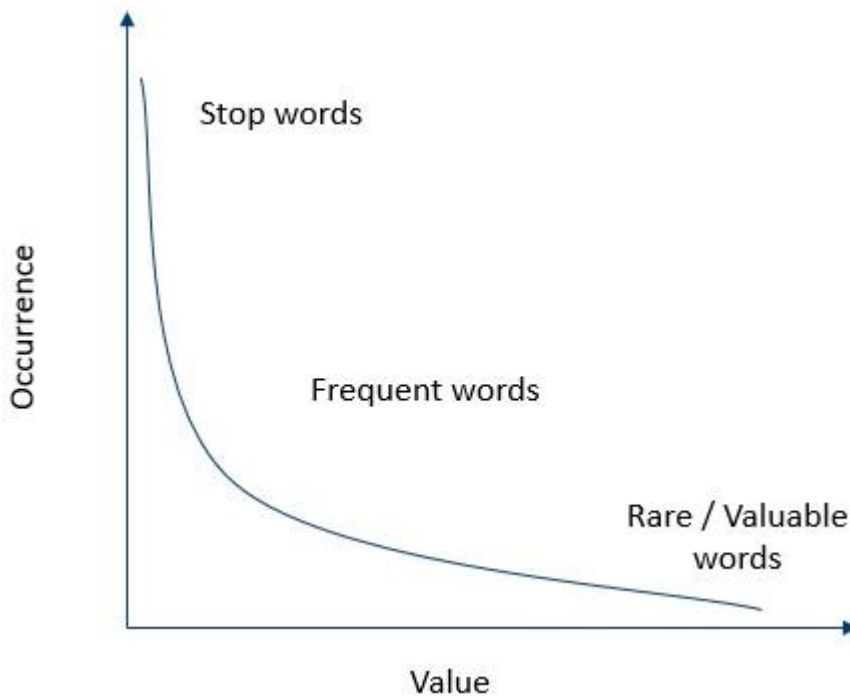
Finally, this gives us the **document vector table** for our corpus. But the tokens have still not converted to numbers. This leads us to the final steps of our algorithm: TFIDF.

### TFIDF: Term Frequency & Inverse Document Frequency

Bag of words algorithm gives us the frequency of words in each document we have in our corpus. It gives us an idea that if the word is occurring more in a document, its value is more for that document. For example, if I have a document on air pollution, air and pollution would be the words which occur many times in it. And these words are valuable too as they give us some context around the document. But let us suppose we have 10 documents and all of them talk about different issues. One is on women empowerment, the other is on unemployment and so on. Do you think air and pollution would still be one of the most occurring words in the whole corpus? If not, then which words do you think would have the highest frequency in all of them?

And, this, is, the, etc. are the words which occur the most in almost all the documents. But these words do not talk about the corpus at all. Though they are important for humans as they make the statements understandable to us, for the machine they are a complete waste as they do not provide us with any information regarding the corpus. Hence, these are termed as stopwords and are mostly removed at the pre-processing stage only.





Take a look at this graph. It is a plot of occurrence of words versus their value. As you can see, if the words have highest occurrence in all the documents of the corpus, they are said to have negligible value hence they are termed as stop words. These words are mostly removed at the pre-processing stage only. Now as we move ahead from the stop words, the occurrence level drops drastically and the words which have adequate occurrence in the corpus are said to have some amount of value and are termed as frequent words. These words mostly talk about the document's subject and their occurrence is adequate in the corpus. Then as the occurrence of words drops further, the value of such words rises. These words are termed as rare or valuable words. These words occur the least but add the most value to the corpus. Hence, when we look at the text, we take frequent and rare words into consideration.

TFIDF stands for Term Frequency and Inverse Document Frequency.

TFIDF helps us in identifying the value for each word.

### Term Frequency

Term frequency is the frequency of a word in one document. Term frequency can easily be found from the document vector table as in that table we mention the frequency of each word of the vocabulary in each document.

aman	and	anil	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0
1	0	0	0	0	1	1	1	1	0	0	0
0	0	1	0	0	1	1	1	0	1	1	1

Here, you can see that the frequency of each word for each document has been recorded in the table. These numbers are nothing but the Term Frequencies!

### Inverse Document Frequency

Now, let us look at the other half of TFIDF which is Inverse Document Frequency. For this, let us first understand what does document frequency mean. Document Frequency is the number of documents in which the word occurs irrespective of how many times it has occurred in those documents. The document frequency for the exemplar vocabulary would be:

aman	and	anil	are	stressed	went	to	a	therapist	download	health	Chatbot
2	1	2	1	1	2	2	2	1	1	1	1

Here, you can see that the document frequency of 'aman', 'anil', 'went', 'to' and 'a' is 2 as they have occurred in two documents. Rest of them occurred in just one document hence the document frequency for them is one.

Talking about inverse document frequency, we need to put the document frequency in the denominator while the total number of documents is the numerator. Here, the total number of documents are 3, hence inverse document frequency becomes:

aman	and	anil	are	stressed	went	to	a	therapist	download	health	chatbot
3/2	3/1	3/2	3/1	3/1	3/2	3/2	3/2	3/1	3/1	3/1	3/1

Finally, the formula of TFIDF for any word W becomes:

$$TFIDF(W) = TF(W) * \log( IDF(W) )$$

Here, log is to the base of 10. Don't worry! You don't need to calculate the log values by yourself. Simply use the log function in the calculator and find out!

Now, let's multiply the IDF values to the TF values. Note that the TF values are for each document while the IDF values are for the whole corpus. Hence, we need to multiply the IDF values to each row of the document vector table.

aman	and	anil	are	stress	went	to	a	therapist	download	health	chatbot
1*log(3/2)	1*log(3)	1*log(3/2)	1*log(3)	1*log(3)	0*log(3/2)	0*log(3/2)	0*log(3/2)	0*log(3)	0*log(3)	0*log(3)	0*log(3)
1*log(3/2)	0*log(3)	0*log(3/2)	0*log(3)	0*log(3)	1*log(3/2)	1*log(3/2)	1*log(3/2)	1*log(3)	0*log(3)	0*log(3)	0*log(3)
0*log(3/2)	0*log(3)	1*log(3/2)	0*log(3)	0*log(3)	1*log(3/2)	1*log(3/2)	1*log(3/2)	0*log(3)	1*log(3)	1*log(3)	1*log(3)

Here, you can see that the IDF values for Aman in each row is the same and similar pattern is followed for all the words of the vocabulary. After calculating all the values, we get:

aman	and	anil	are	stress	went	to	a	therapist	download	health	chatbot
0.176	0.477	0.176	0.477	0.477	0	0	0	0	0	0	0
0.176	0	0	0	0	0.176	0.176	0.176	0.477	0	0	0
0	0	0.176	0	0	0.176	0.176	0.176	0	0.477	0.477	0.477

Finally, the words have been converted to numbers. These numbers are the values of each for each document. Here, you can see that since we have less amount of data, words like 'are' and 'and' also have a high value. But as the IDF value increases, the value of that word decreases. That is, for example:

Total Number of documents: 10

Number of documents in which 'and' occurs: 10

Therefore,  $IDF(\text{and}) = 10/10 = 1$

Which means:  $\log(1) = 0$ . Hence, the value of 'and' becomes 0.

On the other hand, number of documents in which 'pollution' occurs: 3

$IDF(\text{pollution}) = 10/3 = 3.3333\dots$

Which means:  $\log(3.3333) = 0.522$ ; which shows that the word 'pollution' has considerable value in the corpus.

Summarising the concept, we can say that:

1. Words that occur in all the documents with high term frequencies have the least values and are considered to be the stop words.
2. For a word to have high TFIDF value, the word needs to have a high term frequency but less document frequency which shows that the word is important for one document but is not a common word for all documents.
3. These values help the computer understand which words are to be considered while processing the natural language. The higher the value, the more important the word is for a given corpus.
- 4.

## Applications of TF-IDF

1. Document Classification: TF-IDF helps in classifying the type and genre of a document by looking at the frequencies of words in the text. Based on the TF-IDF values, it is easy to classify emails as spam or ham, to classify news as real or fake and so on.
2. Topic Modelling: It helps in predicting the topic for the corpus. Topic modelling refers to a method of identifying short and informative descriptions of a document in a large collection that can further be used for various text mining tasks such a summarisation, document classification etc.
3. Key word Extraction: It is also useful for extracting keywords from text.
4. Information Retrieval System: To extract the important information out of a corpus.

5. Stop word Filtering: It helps in removing unnecessary words out of a text body.

NLTK is a leading platform for building Python programs to work with human language data. It provides easy-to-use interfaces to [over 50 corpora and lexical resources](#) such as WordNet, along with a suite of text processing libraries for classification, tokenization, stemming, tagging, parsing, and semantic reasoning, wrappers for industrial-strength NLP libraries, and an active [discussion forum](#).

NLTK is suitable for linguists, engineers, students, educators, researchers, and industry users alike. NLTK is available for Windows, Mac OS X, and Linux. Best of all, NLTK is a free, open source, community-driven project.

NLTK has been called “a wonderful tool for teaching, and working in, computational linguistics using Python,” and “an amazing library to play with natural language.”

[Natural Language Processing with Python](#) provides a practical introduction to programming for language processing. Written by the creators of NLTK, it guides the reader through the fundamentals of writing Python programs, working with corpora, categorizing text, analyzing linguistic structure, and more.

## Installing NLTK

NLTK requires Python versions 3.7, 3.8, 3.9 or 3.10

### Setting up a Python Environment (Mac/Unix/Windows)

#### Mac/Unix

1. Install NLTK: run `pip install --user -U nltk`
2. Install Numpy (optional): run `pip install --user -U numpy`
3. Test installation: run `python` then type `import nltk`

For older versions of Python it might be necessary to install `setuptools`

(see <https://pypi.python.org/pypi/setuptools>) and to install `pip` (`sudo easy_install pip`).

#### Windows

These instructions assume that you do not already have Python installed on your machine.

### 32-bit binary installation

1. Install Python 3.8: <https://www.python.org/downloads/> (avoid the 64-bit versions)
2. Install Numpy (optional): <https://www.scipy.org/scipylib/download.html>
3. Install NLTK: <https://pypi.python.org/pypi/nltk>
4. Test installation: `Start>Python38`, then type `import nltk`

## Installing NLTK Data

After installing the NLTK package, please do install the necessary datasets/models for specific functions to work.

If you're unsure of which datasets/models you'll need, you can install the "popular" subset of NLTK data, on the command line type `python -m nltk.downloader popular`, or in the Python interpreter `import nltk; nltk.download('popular')`

For details, see <https://www.nltk.org/data.html>

\*\*\*\*\*

## ACTIVITY - Text Processing, BoW

\_Normalize the given text

i) Sentence Segmentation

ii) Tokenisation

Raj and Vijay are best friends. They play together with other friends. Raj likes to play football but Vijay prefers to play online games. Raj wants to be a footballer. Vijay wants to become an online gamer.

Normalization of the given text: Sentence Segmentation:

1. Raj and Vijay are best friends.
2. They play together with other friends.
3. Raj likes to play football but Vijay prefers to play online games.
4. Raj wants to be a footballer.
5. Vijay wants to become an online gamer.

Tokenization:

Raj	and	Vijay	are	best	friends	.							
The	play	togethe	with	other	friends	.							
	y	r											
Raj	likes	to	play	footbal	but	Vijay	prefer	s	t	o	play	onlin	game
				l			s				e	s	
Raj	want	to	be	a	footballe	.							
	s				r								
Vijay	want	to	becom	an	online	game	.						
	s		e			r							

## II) Implement the bag of words Algorithm-Activity

Activity-1 Through a step-by-step process, calculate TFIDF for the given corpus

Document 1: Divya and Rani both are stressed

Document 2: Rani went to a therapist

Document 3: Divya went to download a health chatbot

The above example consists of three documents having one sentence each. After text normalization, the text would be:

Document 1: [Divya, and, Rani, both, are, stressed]

Document 2: [Rani, went, to, a, therapist]

Document 3:[ Divya, went, to, download, a, health, chatbot]

Note that no tokens have been removed in the stopwords removal step.It is because we have very little data and since the frequency of all the words is almost the same, no word can be said to have lesser value than the other.

### Step 2 Create a Dictionary

To create a dictionary write all words which occurred in the three documents.

### Dictionary:

Divya	and	Rani	went	are	stressed
to	a	therapist	download	health	chatbot

In this step, the repeated words are written just once and we create a list of unique words.

### Step 3 Create a document vector

	Divya	and	Rani	went	are	stressed	to	a	therapist	download	health	chatbot
Document 1	1	1	1	0	1	1	0	0	0	0	0	0
Document 2	0	0	1	1	0	0	1	1	1	0	0	0
Document 3	1	0	0	1	0	0	1	1	0	1	1	1

## **TFIDF (Term Frequency and Inverse Document Frequency)**

There are two terms in TFIDF, namely **Term Frequency** and **Inverse Document Frequency**.

## Term Frequency

Divya	and	Rani	went	are	stressed	to	a	therapist	download	health	chatbot
1	1	1	0	1	1	0	0	0	0	0	0
0	0	1	1	0	0	1	1	1	0	0	0
1	0	0	1	0	0	1	1	0	1	1	1

## Inverse Document Frequency

Divya	and	Rani	went	are	stressed	to	a	therapist	download	health	chatbot
2	1	2	2	1	1	2	2	1	1	1	1

## IDF for each word

Divya	and	Rani	went	are	stressed	to	a	therapist	download	health	chatbot
3/2	3/1	3/2	3/2	3/1	3/1	3/2	3/2	3/1	3/1	3/1	3/1

- The formula is

$$TFIDF(W) = TF(W) * \log( IDF(W) )$$

Divya	and	Rani	went	are	stressed	to	a	therapist	down
$1 * \log(3/2)$	$1 * \log(3)$	$1 * \log(3/2)$	$0 * \log(3/2)$	$1 * \log(3)$	$1 * \log(3)$	$0 * \log(3/2)$	$0 * \log(3/2)$	$0 * \log(3/1)$	$0 * \log(3/1)$
0	0	1	$1 * \log(3/2)$	0	$0 * \log(3)$	1	1	$1 * \log(3)$	$0 * \log(3/1)$
$0 * \log(3/2)$	$0 * \log(3)$	$1 * \log(3/2)$	$1 * \log(3/2)$	$0 * \log(3)$	$0 * \log(3)$	$1 * \log(3/2)$	$1 * \log(3/2)$	$1 * \log(3)$	$0 * \log(3/1)$
1	0	0	$1 * \log(3/2)$	0	$0 * \log(3)$	1	1	$0 * \log(3)$	$1 * \log(3/1)$
$1 * \log(3/2)$	$0 * \log(3)$	$0 * \log(3/2)$	$1 * \log(3/2)$	$0 * \log(3)$	$0 * \log(3)$	$1 * \log(3/2)$	$1 * \log(3/2)$	$0 * \log(3)$	$1 * \log(3/1)$

- The IDF values for each word is as follows:

Divya	and	Rani	went	are	stressed	to	a	therapist	download	health	chatbot
0.176	0.477	0.176	0	0.477	0.477	0	0	0	0	0	0
0	0	0.176	0.176	0	0	0.176	0.176	0.477	0	0	0
0.176	0	0	0.176	0	0	0.176	0.176	0	0.477	0.477	0.477

Total Number of documents: 10

Number of documents in which 'and' occurs: 10

Therefore,  $IDF(\text{and}) = 10/10 = 1$

Which means:  $\log(1) = 0$ .

Hence, the value of 'and' becomes 0.

On the other hand, suppose a number of documents in which 'Artificial' occurs:

3  $IDF(\text{Artificial}) = 10/3 = 3.3333\dots$

This means  $\log(3.3333) = 0.522$ ; which shows that the word 'pollution' has considerable value in the corpus

\*\*\*\*\*

Activity-2) Through a step-by-step process, calculate TFIDF for the given corpus

Document 1: Johny Johny, Yes Papa,

Document 2: Eating sugar? No Papa

Document 3: Telling lies? No Papa

Document 4: Open your mouth, Ha! Ha! Ha!

1. Create document vectors for the given documents (Term Frequency Table)\



Johny	Yes	Papa	Eating	Sugar	No	Telling	Lies	Open	your	Mouth	Ha
2	1	1	0	0	0	0	0	0	0	0	0
0	0	1	1	1	1	0	0	0	0	0	0
0	0	1	0	0	1	1	1	0	0	0	0
0	0	0	0	0	0	0	0	1	1	1	3

2. Record the occurrence of the word in the document using term frequency table (Document Frequency Table)

Johny	Yes	Papa	Eating	Sugar	No	Telling	Lies	Open	your	Mouth	Ha
1	1	3	1	1	2	1	1	1	1	1	1

3. Draw the inverse document frequency table wherein, we need to put the document frequency in the denominator while the total number of documents is the numerator. Here, the total number of documents are 4, hence inverse document frequency becomes:

Johny	Yes	Papa	Eating	Sugar	No	Telling	Lies	Open	your	Mouth	Ha
4/1	4/1	4/3	4/1	4/1	4/2	4/1	4/1	4/1	4/1	4/1	4/1

4. The formula of TFIDF for any word W becomes:  $TFIDF(W) = TF(W) * \log (IDF(W))$

Johny	Yes	Papa	Eating	Sugar	No	Telling	Lies	Open	your	Mouth	Ha
$2 \cdot \log(4/1)$	$1 \cdot \log(4/1)$	$1 \cdot \log(4/3)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/2)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$
$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$1 \cdot \log(4/3)$	$1 \cdot \log(4/1)$	$1 \cdot \log(4/1)$	$1 \cdot \log(4/2)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$
$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$1 \cdot \log(4/3)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$1 \cdot \log(4/2)$	$1 \cdot \log(4/1)$	$1 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$
$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/3)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/2)$	$0 \cdot \log(4/1)$	$0 \cdot \log(4/1)$	$1 \cdot \log(4/1)$	$1 \cdot \log(4/1)$	$1 \cdot \log(4/1)$	$3 \cdot \log(4/1)$

### **MCQ (Answers are bolded)**

- .....is a process to reduce the variations in text's word forms to a common form when the variations mean the same thing  
**a) Text Normalisation**      b) Sentence segmentation  
c) Tokenisation                      d) Stemming and Lemmatisation
- .....is the process of dividing the whole text into smaller components, i.e., individual sentences  
a) Text normalisation      **b) Sentence segmentation**      c) Tokenisation      d) Stemming and Lemmatisation
- ..... are well –defined semantic units inside a sentence and contributes to overall meaning of the sentence.  
**a) Syntax**                      b) Semantics                      c) Tokens                      d) Stop words
- A token may represent all of these  
**a) Word**    b) phrase    c) number    d) symbol    **e) All of these**
- .....is the process of splitting up of individual sentences into smaller units called token (a word, a phrase, a number or a symbol)  
a) Text normalisation      b) Sentence segmentation      **c) Tokenisation**  
d) Stemming and Lemmatisation
- ..... are the words in any language which do not add much meaning to a sentence. They can safely be ignored without sacrificing the meaning of the sentence.

- a) Syntax    b) Semantics    c) Tokens    **d) Stop words**

7. The process of extracting the root form of the word is known as .....

- a) Tokenisation    **b) Stemming**    c) Lemmatisation    d) Segmentation

8. The words extracted through stemming are called .....

- a) tokens    b) lemmas    **c) stems**    d) All of these

9. A..... is the part of the word to which the inflectional (changing/deriving) affixes are added such as (-ed, -ize, -s, -de, mis etc.)

- a) Token    b) lemma    **c) stem**    d) all of these

10..... Is the process of converting a word to its actual root form as per the language.

- a) Tokenisation    b) Stemming    **c) Lemmatisation**    d) Segmentation

11. The words extracted through lemmatisation are called .....

- a) tokens    **b) lemmas**    c) stems    d) all of these

12. A ..... Is the base form of all its inflectional forms, whereas a stem isn't

- a) Token    b) **lemma**    c) stem    d) all of these

13. Regular dictionaries contain .....

- a) Token    **b) lemmas**    **c) stem**    d) affixes

14. A..... is a model used for extracting features from text for use in AI based modelling.

- a) bag of words**    b) Text Normalisation

- c) Sentence segmentation    d) None of these

15. .... is a statistical measure that evaluates how relevant a word is to a document in a collection of documents .

- a) TF    b) IDF    **c) TF -IDF**    d) All of these

### **VERY SHORT ANSWER QUESTIONS(1 Mark)**

1. What is text normalisation?

Text normalisation is the process to reduce the variations in text's word forms to a common form when the variations mean the same thing.

2. What is a corpus?

The whole collection of words from all the documents being processed is called corpus.

3. What is tokenisation?

Tokenisation is the process of splitting up individual sentences into smaller units called token.

4. What are stop words?

Stop words are words in any language which do not add much meaning to a sentence.

5. What do you mean by stemming?

The process of extracting the root form of the word by removing affixes is known as stemming.

6. What is lemmatisation?

It is the process of converting a word to its actual root form linguistically.

7. What is case normalisation?

Case normalisation refers to conversion of all the words in the same case. (often lower case)

8. What is Bag – of-words?

Bag – of-words is a model used for extracting features from text for use in modelling, with many AI algorithms.

9. What is TF-IDF?

TF-IDF is a statistical measure that evaluates how relevant a word is to a document in a collection of documents.

10 What does TF-IDF refer to?

TF-IDF refers Term Frequency-Inverse Document Frequency

11. What is TF?

TF (Term Frequency) ia the frequency of a word in the document

12. What is IDF?

IDF (Inverse Document Frequency) refers to how common a rare word is in the entire document set

13. What will be the output of the word “studies” if we do the following?

a) Lemmatization      b) Stemming

Ans: a) study      b) studi

14. How many tokens are there in the sentence given below?

Traffic Jams have become a common part of our lives nowadays. Living in an urban area means you have to face traffic each and every time you get out on the road. Mostly, school students opt for buses to go to school.

Ans: 46 tokens

15. Identify the stop words in the given sentence:

Pollution is the introduction of contaminants into the natural environment that cause adverse change. The three types of pollution are air pollution, water pollution and land pollution.

Ans: is, the, of, that, into, are, and

16. What is NLTK?

NLTK or Natural Language Toolkit is a python package that you can use for NLP.

### **Short Answer Questions (2 Marks)**

1. What is a token?

A token is a well- defined semantic unit inside a sentence and contributes to overall meaning of the sentence. A token may represent a word, a phrase, a number or a symbol.

2. What is the difference between stems and lemmas?

Stem is the root word generated by stemming process and the lemma is the root word generated by lemmatisation process.

Stemming and Lemmatisation both generate the foundation sort of the inflected words, but the difference between a stem and a lemma is that a stem may not be an actual word in the dictionary, whereas, a lemma is an actual language word.

3. What are some applications of TF-IDF?

TF-IDF is commonly used for processing huge datasets of documents, usually by search-engines.

Some common applications of TF-IDF are: Document Classification, Topic Modelling, Keyword extraction, Information Retrieval System, Stop-word filtering.

### **Long Answer questions (3 Marks)**

1. What is Stemming?

Stemming is the process of removing a part of a word, or reducing to its stem or root, e.g., in stemming, the word "studies" gets reduced to its stem 'studi' with 'ed' removed; similarly, the word 'advisable' gets reduced to its stem 'advis'.

A Stem is the root of the word to which an affix is added to make this word. Stem may or may not be equal to a word in dictionary.

## 2. What is lemmatisation?

Lemmatisation is very similar to stemming, where the goal is to remove inflections from the word and map a word to its root form. But unlike stemming, lemmatisation tries to do it the proper way. It doesn't just chop things off, it actually transforms words to the actual root, a real word in dictionary. The reduced forms resulting out of lemmatisation are called lemmas.

For example, in lemmatisation the word "studied" get reduced to its lemma 'study' similarly, the word 'advisable' gets reduced to its lemma 'advise'.

## 3. What is bag of words? What does it do?

A Bag-of-Words (BoW) model is a way of extracting features from text for use in modelling, with many AI algorithms. bag-of-words is a representation of text that describes the occurrence of words within a document.

A Bag-of-words contain two things

- i) A vocabulary of known words
- ii) A measure of presence of known words

It is called a Bag -of-words because it contains just the collections of words without any information about the order or structure of words in the document. It only tells that the known words occur in the document, not their positioning in the document.

## 4. What is NLTK?

NLTK is a Python Package that you can use for NLP. It is a platform used for building Python programs that work with human language data for applying in statistical natural language processing (NLP). It contains text processing libraries for tokenisation, parsing, classification, stemming, tagging and semantic reasoning.

### **Very Long Answer Questions (4 marks)**

#### 1. What is text normalisation? What is its use in NLP?

Text normalisation is the process of transforming a text into a canonical (standard) form, e.g. the word "gooood" and "gud" can be transformed to "good" , its canonical form .

After text normalisation, only the real, contributing words are left in the text, which is useful in NLP in two ways:

- (i) The dataset size is now reduced with unimportant words removed and thus less processing is required.
- (ii) It is easier to gauge the intent from the remaining words.

#### 2. Write the steps of Text normalisation? Explain.

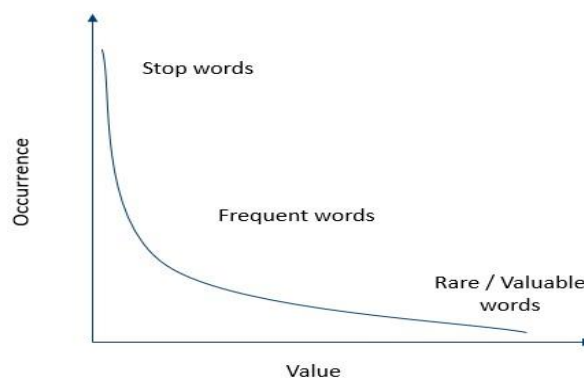
The steps of Text normalisation are:

1. Sentence Segmentation: It is the process of dividing the whole text into smaller components, i.e., individual sentences
2. Tokenisation is the process of splitting up individual sentences into smaller units called token.

3. Removing punctuation and stop words: In this step, the unnecessary tokens are removed from the token list.
4. Stemming: In this step the remaining words are reduced to their root words
5. Converting text to a common case: Here the whole text is converted into a similar case, preferably lower case.
6. Lemmatisation: It is the process of converting a word to its actual root form linguistically.

3. Explain from the given graph, how the value and occurrence of a word are related in a corpus?

As shown in the graph, occurrence and value of a word are inversely proportional. The words which occur most (like stop words) have negligible value. As the occurrence of the words drops, the value of such words rises. These words are termed as rare or valuable words. These words occur the least but add the most value to the corpus.



4. Write the steps to implement bag of words algorithm.

1. Text Normalisation: Collect data and pre-process it by removing the known stop words.
2. Design the vocabulary. Prepare the corpus (a collection of words) from the words in the document. The whole collection of textual data from all the documents is called corpus.
3. Create Document vectors. Score the word's frequency in the document.
4. Calculate TF-IDF. Calculate Term Frequency and Inverse Document Frequency.

5. What are some applications of TF-IDF?

**Document Classification:** TF-IDF helps in classifying the type and genre of a document by looking at the frequencies of words in the text. Based on the TF-IDF values, it is easy to classify emails as spam or ham, to classify news as real or fake and so on.

**Topic Modelling:** It helps in predicting the topic for the corpus. Topic modelling refers to a method of identifying short and informative descriptions of a document in a large collection that can further be used for various text mining tasks such as summarisation, document classification etc.

**Key word Extraction:** It is also useful for extracting keywords from text.

**Information Retrieval System:** To extract the important information out of a corpus.

**Stop word Filtering:** It helps in removing unnecessary words out of a text body.

## EVALUATION

### Activity: 1

Imagine that you have come up with an AI-based prediction model which has been deployed on the roads to check traffic jams. Now, the objective of the model is to predict whether there will be a traffic jam or not. Now, to understand the efficiency of this model, we need to check if the predictions which it makes are correct or not. Thus, there exist two conditions which we need to ponder upon: Prediction and Reality.

Traffic Jams have become a common part of our lives nowadays. Living in an urban area means you have to face traffic each and every time you get out on the road. Mostly, school students opt for buses to go to school. Many times, the bus gets late due to such jams and the students are not able to reach their school on time.

Considering all the possible situations make a Confusion Matrix for the above situation.

### Ans:

Case 1: Is there a traffic Jam?

Prediction: Yes Reality: Yes True Positive

Case 2: Is there a traffic Jam?

Prediction: No Reality: No True Negative

Case 3: Is there a traffic Jam?

Prediction: Yes Reality: No False Positive

Case 4: Is there a traffic Jam?

Prediction: No Reality: Yes False Negative.

The confusion Matrix		Reality	
		Yes	No
Prediction	Yes	True Positive TP	False Positive FP
	No	False Negative FN	True Negative TN

### Activity: 2

Shweta is learning NLP. She read about the F1 score but did not understand the need for the F1 score formulation. Support her by giving an answer.

### Ans.:

The F1 score is also known as the F score or F measure of AI model's test accuracy. It is calculated from the precision and recall of the test. Here



1) The precision is the number of correctly recognized positive results divided by the number of all positive results, including those not identified correctly.

2) The recall is the number of correctly identified positive results divided by the number of all samples that should have been identified as positive.

3) The F1 score is defined as the harmonic mean of the test's precision and recall. The formula of F1 score is as below:

$$F1 \text{ Score} = 2 \times \frac{(\text{Precision} \times \text{Recall})}{(\text{Precision} + \text{Recall})}$$

From this formula,

i) A good F1 score means that you have high true positives and high true negatives. It means that the machine is correctly identifying real threats and not disturbs the users by false alarms.

ii) An F1 score is considered perfect when it's 1 while the model is a total failure when it's 0.

iii) F1 score is a better metric to evaluate the model on real-life classification problems and when imbalanced class distribution exists.

### Activity: 3

Calculate accuracy, precision, recall, and F1 score for the following Confusion Matrix. Suggest which metric would not be a good evaluation parameter and why?

The Confusion Matrix	Reality: 1	Reality: 0
Prediction: 1	50 TP	30 FP
Prediction: 0	15 FN	25 TN

**Ans:**

a) Accuracy: It is defined as the percentage of correct predictions out of all the observations.

$$\text{Accuracy} = \frac{(TP+TN)}{(TP+FN+TN+FP)} \times 100\%$$

$$\frac{(50+25)}{(50+15+25+30)} \times 100\% = \frac{80}{120} \times 100\% = 0.67$$

b) Precision: It is defined as the percentage of true positive cases versus all the cases where the prediction is true.

$$\text{Precision} = \frac{TP}{(FP+TP)} = \frac{50}{(30+50)} = \frac{50}{80} = 0.625$$

c) Recall: It is defined as the fraction of positive cases that are correctly identified.

$$\text{Recall} = \frac{TP}{(FN+TP)} = \frac{50}{(15+50)} = \frac{50}{65} = 0.769$$

d) F1 Score: It is identified as the measure of balance between precision and recall.

$$\text{F1 Score} = 2X \frac{(\text{Precision} \times \text{Recall})}{(\text{Precision} + \text{Recall})}$$

$$2X \frac{(0.625 \times 0.769)}{(0.625 + 0.769)} = 2X \frac{0.96125}{1.394} = 0.7$$

**Accuracy = 0.67                  Precision = 0.625**

**Recall = 0.769                  F1 Score = 0.7**

By this results, recall is not good evaluation metric it needs to improve more. Two conditions are very risk here:

1) False Positive: Suppose if we see the above confusion matrix for the heart attack cases then a person is predicted with heart attack but does not have heart attack in reality.

2) False Negative: A person is predicted with no heart attack but in reality person is suffering from the heart attack.

Hence False negative miss the actual patients. So recall needs more improvement.

#### Activity: 4

In schools, a lot of times it happens that there is no water to drink. At a few places, cases of water shortage in schools are very common and prominent. Hence, an AI model is designed to predict if there is going to be a water shortage in the school in the near future or not. The confusion matrix for the same is:

The Confusion Matrix	Reality: 1	Reality: 0
Prediction: 1	22 TP	12 FP
Prediction: 0	47 FN	118 TN

Find out Accuracy, Precision, Recall and F1 Score for the given problems.

**Ans:**

Calculation:

$$1. \text{ Accuracy} = \frac{(TP+TN)}{(TP+FN+TN+FP)} \times 100\%$$

$$\frac{(22+118)}{(22+47+118+12)} \times 100\% = \frac{140}{199} \times 100\% = 0.703$$

$$2. \quad \text{Precision} = \frac{TP}{(FP+TP)} = \frac{22}{(12+22)} = 0.647$$

$$3. \quad \text{Recall} = \frac{TP}{(FN+TP)} = \frac{22}{(47+22)} = 0.318$$

$$4. \quad \text{F1 Score} = 2X \frac{(\text{Precision} \times \text{Recall})}{(\text{Precision} + \text{Recall})}$$

$$2X \frac{(0.647 \times 0.318)}{(0.647 + 0.318)} = 2X \frac{0.205746}{0.965} = 2X0.213 = 0.426$$

**Accuracy = 0.703**

**Precision = 0.647**

**Recall = 0.318**

**F1 Score = 0.426**

## ADVANCE PYTHON

### Jupyter Notebook

The Jupyter Notebook is an incredibly powerful tool for interactively developing and presenting AI related projects. The Jupyter project is the successor to the earlier IPython and it is an interactive way of running python code in the terminal using the REPL model. (Read Eval Print Loop)

Jupyter Notebook is an open-source, web-based interactive environment, which allows you to create and share documents that contain live code, mathematical equations, graphics, maps, plots, visualizations, and narrative text. It integrates with many programming languages like Python, PHP, R, C#, etc.

### Advantages of Jupyter Notebook

1. **All in one place:** As you know, Jupyter Notebook is an open-source web-based interactive environment that combines code, text, images, videos, mathematical equations, plots, maps, graphical user interface and widgets to a single document.
2. **Easy to convert:** Jupyter Notebook allows users to convert the notebooks into other formats such as HTML and PDF. It also uses online tools and nbviewer which allows you to render a publicly available notebook in the browser directly.
3. **Easy to share:** Jupyter Notebooks are saved in the structured text files (JSON format), which makes them easily shareable.
4. **Language independent:** Jupyter Notebook is platform-independent because it is represented as JSON (JavaScript Object Notation) format, which is a language-independent, text-based file format. Another reason is that the notebook can be processed by any programming language, and can be converted to any file formats such as Markdown, HTML, PDF, and others.
5. **Interactive code:** Jupyter notebook uses **ipywidgets** packages, which provide many common user interfaces for exploring code and data interactivity.

### Installing Jupyter Note Book

1. Installation using Anaconda

The easiest way to install and start using Jupyter Notebook is through Anaconda. Anaconda is the most widely used Python distribution for data science and comes pre-loaded with all the most popular libraries and tools. With Anaconda, comes the Anaconda Navigator through which we can scroll around all the applications which come along with it. Jupyter notebook can easily be accessed using the Anaconda Prompt with the help of a local host

2. Installation using pip:

Jupyter note book can be installed also using the following code in command prompt

```
>python-m pip install jupyter
```

## Kernels in Jupyter Notebook

A kernel provides programming language support in Jupyter. IPython is the default kernel for Jupyter Notebook. Therefore, whenever we need to work with Jupyter Notebook in a virtual environment, we first need to install a kernel inside the environment in which the Jupyter notebook will run.

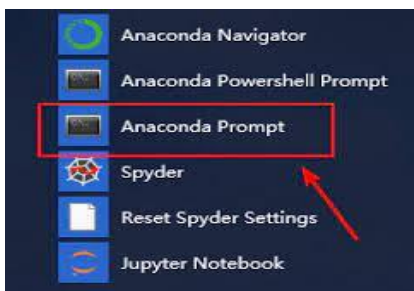
## Virtual environment

A virtual environment is a tool that helps to keep dependencies required by different projects separated, by creating isolated Python virtual environments for them. This is one of the most important tools that most of the Python developers use.

Imagine a scenario where we are working on two Python-based projects and one of them works on Python 2.7 and the other uses Python 3.7. In such situations virtual environment can be really useful to maintain dependencies of both the projects as the virtual environments will make sure that these dependencies are not conflicting with each other and no impact reaches the base environment at any point in time. Thus, different projects developed in the system might have another environment to keep their dependencies isolated from each other.

Creating virtual environments is an easy task with Anaconda distribution. Steps to create one are:

1. Open Anaconda prompt.



2. As we open the Anaconda prompt, we can see that in the beginning of the prompt message, the term (base) is written. This is the default environment in which the anaconda works. Now, we can create our own virtual environment and use it so that the base does not get affected by anything that is done in the virtual environment.

```

Anaconda Prompt
(C:\ProgramData\Anaconda3_nonAdmin) C:\Users\u354590.1>

```

3. Let us now create a virtual environment named env. To create the environment, write `conda create -n env python=3.7`

```

Anaconda Prompt
(base) C:\Users\jamesconda> info

active environment : base
active env location : C:\Users\james\AppData\Local\Continuum\anaconda3
shell level : 1
user config file : C:\Users\james\condarc
populated config files : C:\Users\james\condarc
conda version : 4.7.5
conda-build version : 3.17.6
python version : 3.7.1.final.0
virtual packages : _cuda=0.2
base environment : C:\Users\james\AppData\Local\Continuum\anaconda3 (root@h1c)
channel URLs : https://repo.anaconda.com/pkgs/main/win-64
               https://repo.anaconda.com/pkgs/main/noarch
               https://repo.anaconda.com/pkgs/r/win-64
               https://repo.anaconda.com/pkgs/r/noarch
               https://repo.anaconda.com/pkgs/msys2/win-64
               https://repo.anaconda.com/pkgs/msys2/noarch
package cache : C:\Users\james\AppData\Local\Continuum\anaconda3\pkgs
                 C:\Users\james\conda\pkgs
                 C:\Users\james\AppData\Local\conda\conda\pkgs
envs directories : C:\Users\james\AppData\Local\Continuum\anaconda3\envs
                  C:\Users\james\conda\envs
                  C:\Users\james\AppData\Local\conda\conda\envs

```

4. After some processing, the prompt will ask if we wish to proceed with installation or not. Type `y` on it and press enter. Once we press enter, the packages will start getting installed in the environment.

```

(base) C:\Users\Maxime> activate py3
(py3) C:\Users\Maxime> pip --version
Traceback (most recent call last):
  File "C:\Users\Maxime\Anaconda3\envs\py3\Scripts\pip-script.py", line 6, in <module>
    from pip import main
ImportError: cannot import name 'main'

(py3) C:\Users\Maxime> conda list
# packages in environment at C:\Users\Maxime\Anaconda3\envs\py3:
#
# Name                    Version           Build    Channel
artifactory                2018.1.10         py36_0
legos                      0.0.1h5          *pip*
pip                        9.0.3             py36_0
python                    3.6.5             h8c2914d_0
setuptools                39.0.1            py36_0
six                        1.11.0            h8510f16_3
s2B15_runtime             14.0.25123       py36_3
wheel                     0.31.0           py36_0
uncertainties              0.2               py36h7f05bca_0

(py3) C:\Users\Maxime> python -m pip --version
pip 10.0.0 from C:\Users\Maxime\Anaconda3\lib\site-packages\pip (python 3.6)

```

5. Depending upon the internet speed, the downloading of packages might take varied time. The processing screen will look like this:

6. Once all the packages are downloaded and installed, we will get a message like this

7. This shows that our environment called env has been successfully created. Once an environment has been successfully created, we can access it by writing the following:

### Conda active env

This would activate the virtual environment and we can see the term written in brackets has changed from (base) to (env). Now our virtual environment is ready to be used.

But, to open and work with jupyter notebooks in this environment, we need to install the packages which help in working with jupyter notebook. These packages get installed by default in the base environment when anaconda gets installed.

To install Jupyter Notebook dependencies, we need to activate our virtual environment env and write

### **Conda install ipykernel nb\_conda jupyter**

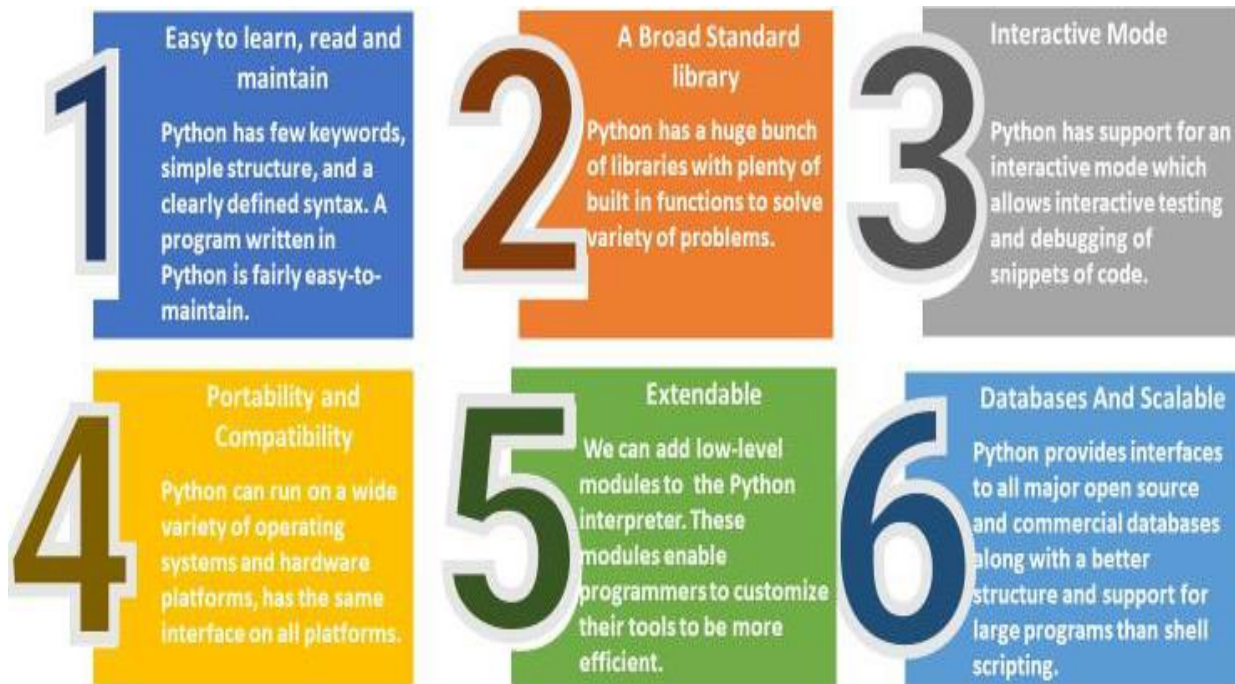
It will again ask if we wish to proceed with the installation, type Y to begin the installation. Once the installations are complete, we can start working jupyter notebooks in this environment.

## **Introduction to Python**

Python is a programming language which was created by Guido Van Rossum . It can be used to follow both procedural approach and object-oriented approach of programming. Python has a lot of functionalities which makes it so popular to use.

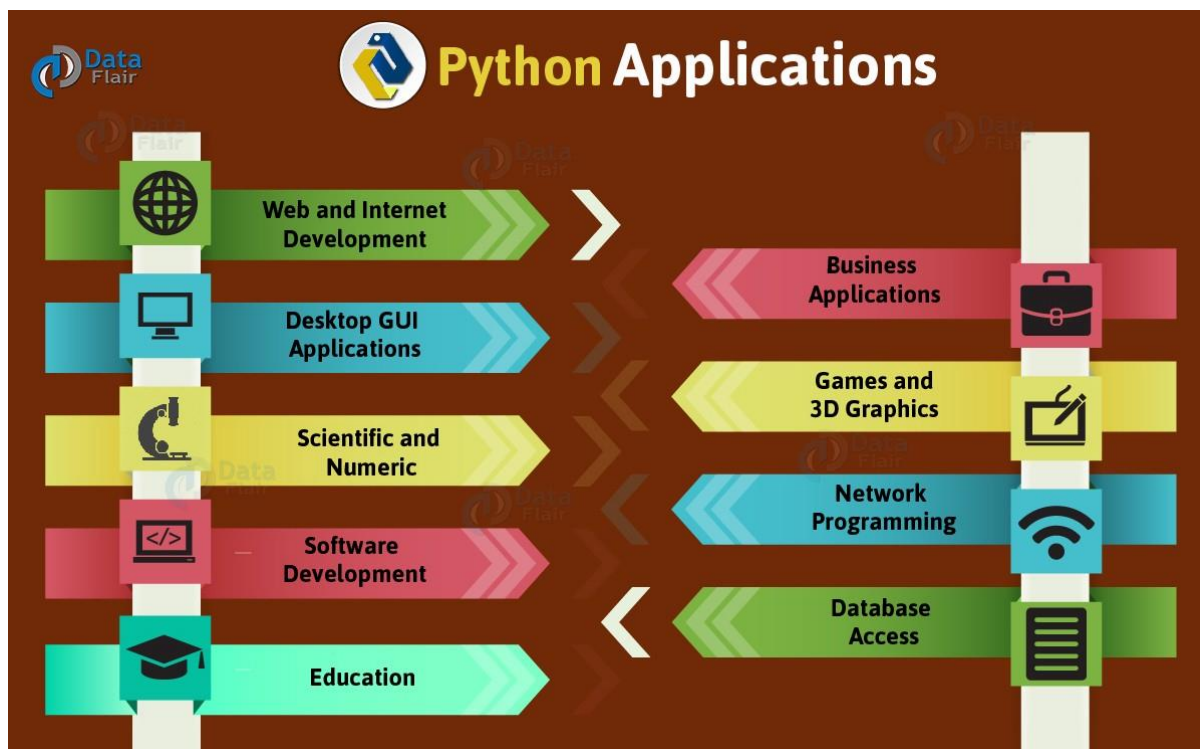
## **Why Python for AI?**

Artificial intelligence is the trending technology of the future. We can see so many applications around us. If we as individuals would also like to develop an AI application, we will need to know a programming language. There are various programming languages like Lisp, Prolog, C++, Java and Python, which can be used for developing applications of AI. Out of these, Python gains a maximum popularity because of the following reasons:



## Applications of Python

There exist a wide variety of applications when it comes to Python. Some of the applications are:





# PYTHON BASICS

## Comments

Comments are the statements which are incorporated in the code to give a better understanding of code statements to the user.

There are two types of comments in python.

1. Single Line
2. Multi Line

### Single Line comment

A single-line comment is used to add some explanatory text in the program for better understanding of the next line. A # sign is used to write a single line comment in the python program  
For example,

```
# statement to add two numbers
res = 6 + 7
#Print the result
print(res)
```

### Multiline comments

The multiline comments are written in python using triple quotes. You can write number lines starting with triple quotes and end with triple quotes.

For example,

```
"""Write a python program to display the difference between two numbers, the first number should
be larger than second number"""
n1=5
n2=2
res=n1 - n2
print(res)
```

### Keywords (Reserved Words)

Keywords are the reserved words or pre-defined words with a special meaning to the machine by default. So the user cannot use them anywhere else or it cannot be changed or modified in the entire program. They are always case-sensitive.

## Keywords in Python

<code>False</code>	<code>class</code>	<code>finally</code>	<code>is</code>	<code>return</code>
<code>None</code>	<code>continue</code>	<code>for</code>	<code>lambda</code>	<code>try</code>
<code>True</code>	<code>def</code>	<code>from</code>	<code>nonlocal</code>	<code>while</code>
<code>and</code>	<code>del</code>	<code>global</code>	<code>not</code>	<code>with</code>
<code>as</code>	<code>elif</code>	<code>if</code>	<code>or</code>	<code>yield</code>
<code>assert</code>	<code>else</code>	<code>import</code>	<code>pass</code>	
<code>break</code>	<code>except</code>	<code>in</code>	<code>raise</code>	

## Identifiers

Identifiers are names used in programs to identify small units of programs such as variables, objects, classes, functions etc.

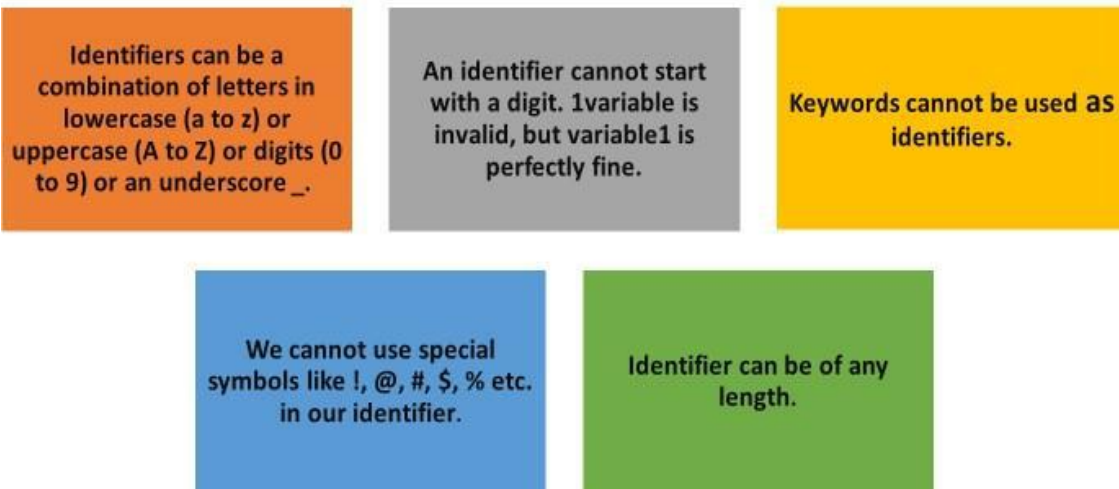
Identifiers defined by the following few rules as follows:

1. It can be a combination of numbers and letters
2. It must start alphabets or underscore
3. Special characters are not allowed in identifiers name except underscore
4. Spaces are not allowed in identifier names, underscore can be used to separate two words
5. Upper Case and Lower Case letters are treated differently

Examples:

MyData, roll\_no, year1 etc...

An identifier is a name given to entities like class, functions, variables, etc. It helps to differentiate one entity from another.



## Variables

A variable is a named location used to store data in the memory. It is helpful to think of variables as a container that holds data which can be changed later throughout programming.

For example,

```
a=10
```

```
b=20
```

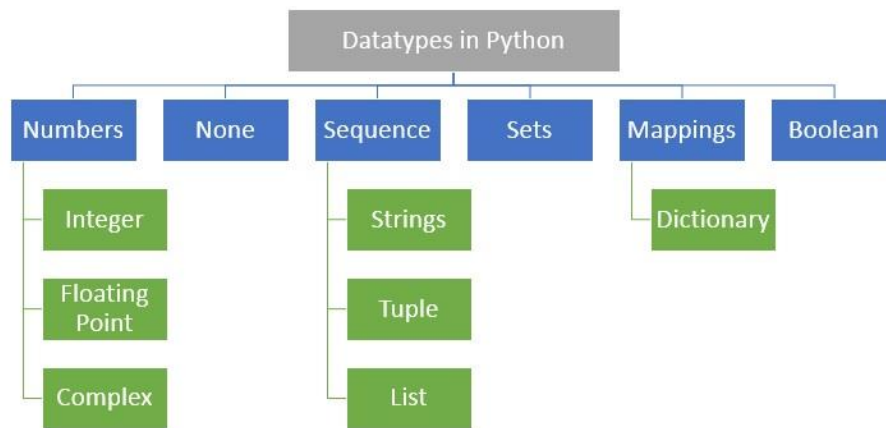
These declarations make sure that the program reserves memory for two variables with the names a and b. The variable names stand for the memory location.

## Note:

Assignment operator is used in Python to assign values to variables. For example, **a = 5** is a simple assignment operator that assigns the value 5 on the right to the variable a on the left.

## Datatypes

In program, you have a choice to use any type of data such as real numbers, numbers with decimals, numbers without decimals, text, etc. These type of data is defined by datatype in Python. The python interprets the type of the variable according to the value stored in the variable. Follow the below-given link to know more about data types.



Python DataTypes

## Python Input and Output

We use the `print()` function to output data to the standard output device (screen). We can also output data to a file.

An example is given below.

```
a = "Hello World!"
```

```
print(a)
```

The output of the above code will be: Hello World!

Example Code	Output
<pre><b>a = 20</b> <b>b = 10</b> <b>print(a + b)</b></pre>	30
<pre><b>print(15 + 35)</b></pre>	50
<pre><b>print("My name is Alan")</b></pre>	<b>My name is Alan</b>
<pre><b>name="Alan"</b> <b>print("My name is ",name)</b></pre>	<b>My name is Alan</b>
<pre><b>n=5</b> <b>print("I have",n,"Apples !")</b></pre>	<b>I have 5 Apples !</b>

## input() function

The input() function is used to accept values from the user at runtime. This function accepts and returns the text data by default. Therefore, you need to specify the data type if you want to use numbers or any other datatype. This process is known as typecasting

```
Str = input(<String>) # Python expects the input to be of string datatype
```

```
Number = int(input(<string>)) # Input string gets converted to an integer value before assignment
```

```
Value = float(input(<String>)) # Input string gets converted to a decimal value before assignment.
```

## Python Operators

Operators are special symbols which represent computation. They are applied on operand(s), which can be values or variables. Some operators can behave differently on different data types. Operators when applied on operands form an expression.

Operators are categorized as Arithmetic, Relational, Logical and Assignment operators.

Values and variables when used with operators are known as operands.

### a. Arithmetic Operators

Operator	Meaning	Expression	Result
+	Addition	10 + 20	30
-	Subtraction	30 - 10	20
*	Multiplication	30 * 100	300
/	Division	30 / 10	20.0
//	Integer Division	25 // 10	2
%	Remainder	25 % 10	5
**	Raised to power	3 ** 2	9

b. Conditional Operators

Operator	Meaning	Expression	Result
>	Greater Than	20 > 10	True
		15 > 25	False
<	Less Than	20 < 45	True
		20 < 10	False
==	Equal To	5 == 5	True
		5 == 6	False
!=	Not Equal to	67 != 45	True
		35 != 35	False
>=	Greater than or Equal to	45 >= 45	True
		23 >= 34	False
<=	Less than or equal to	13 <= 24	True
		13 <= 12	False

c. Logical Operators

Operator	Meaning	Expression	Result
and	And operator	True and True	True
		True and False	False
or	Or operator	True or False	True
		False or False	False
not	Not Operator	not False	True
		not True	False

d. Assignment Operators

Operator	Expression	Equivalent to
=	X=5	X = 5
+=	X +=5	X = X + 5
-=	X -= 5	X = X - 5
*=	X *= 5	X = X * 5
/=	X /= 5	X = X / 5

## Conditional Statements

While coding in Python, sometimes we need to take decisions. For example, if a person needs to create a calculator with the help of a Python code, he/she needs to take in 2 numbers from the user and then ask the user about which function he/she wishes to operate. Now, according to the user's choice, the selection of function would change. In this case, we need the machine to understand what should happen when. This is where conditional statements help.

Conditional statements help the machine in taking a decision according to the condition which gets fulfilled. There exist different types of conditional statements in Python.

Some of them are:



## Simple if Statement

If you have only one condition to be executed or one possibility of output, **simple if statement** is useful for the same. Simple it executes the True condition block. Suppose, If gate is open you are allowed to go inside!

Let's see the syntax:

```
if <condition>:  
    statement(s)
```

Example:

```
gate_status = "open"  
if gate_status=="open":  
    print("Entry is permitted")
```

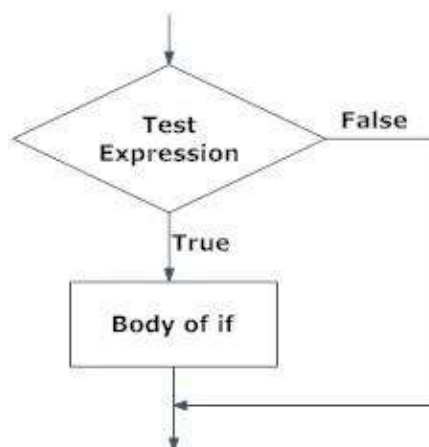


Fig: Operation of if statement.

## if else statement

If else statement evaluates the test expression and will execute body of if only if the condition is true . If the condition is false body of else will be executed .The blocks are separated using proper indentation.

```
if <condition>:
```

```
    statement(s)
```

```
else:
```

```
    statement(s)
```

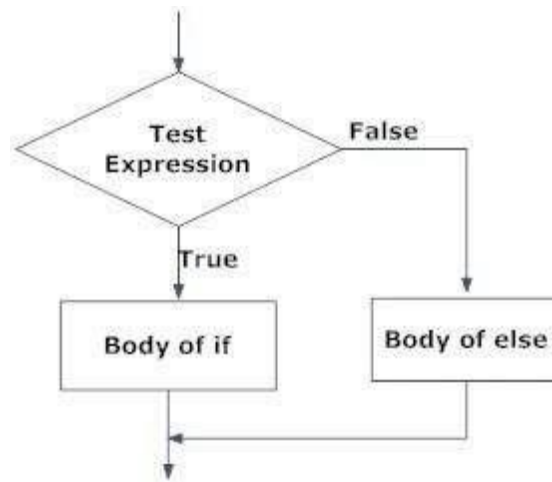


Fig: Operation of if...else statement

Observe the following code:

```
gate_status = "open"
```

```
if gate_status=="open":
```

```
    print("Entry is permitted")
```

```
else:
```

```
    print("You have to go back to your home, Bye - Bye")
```

### **if- elif- else ladder**

Python if-elif-else ladder is used in the case when you have more than two choices or possibilities. The elif is a short form of else if. The ladder means it will continue upto n possibilities.

The syntax for python ef-elif-else ladder is as following:

```
if <condition1>:
```

```
    statement(s)
```

```
elif <condition2>:
```

```
    statement(s)
```

```
elif <condition3>:
```



statement(s)

....

....

....

else:

statement(s)

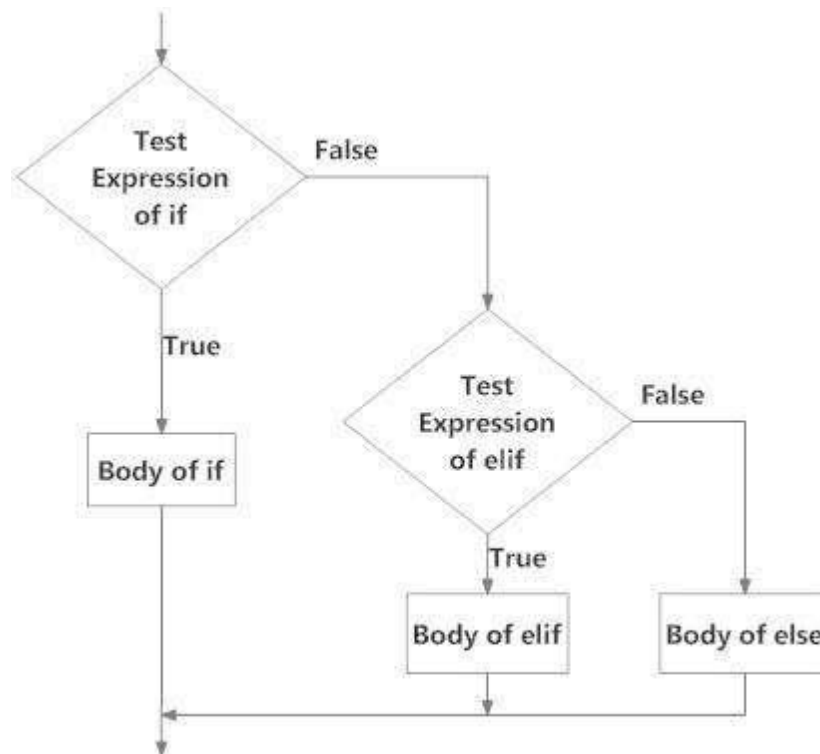


Fig: Operation of if...elif...else statement

**Example :**

```
if num > 0:
    print("Positive number")
elif num == 0:
    print("Zero")
else:
    print("Negative number")
```

**Python loops**

Loops are a collection of statements executed repeatedly until the condition evaluates to false. It is also known as iteration or [iterative statements](#). It can be also considered as step by step execution of python statements until the condition evaluates to false.

## Types of Loop

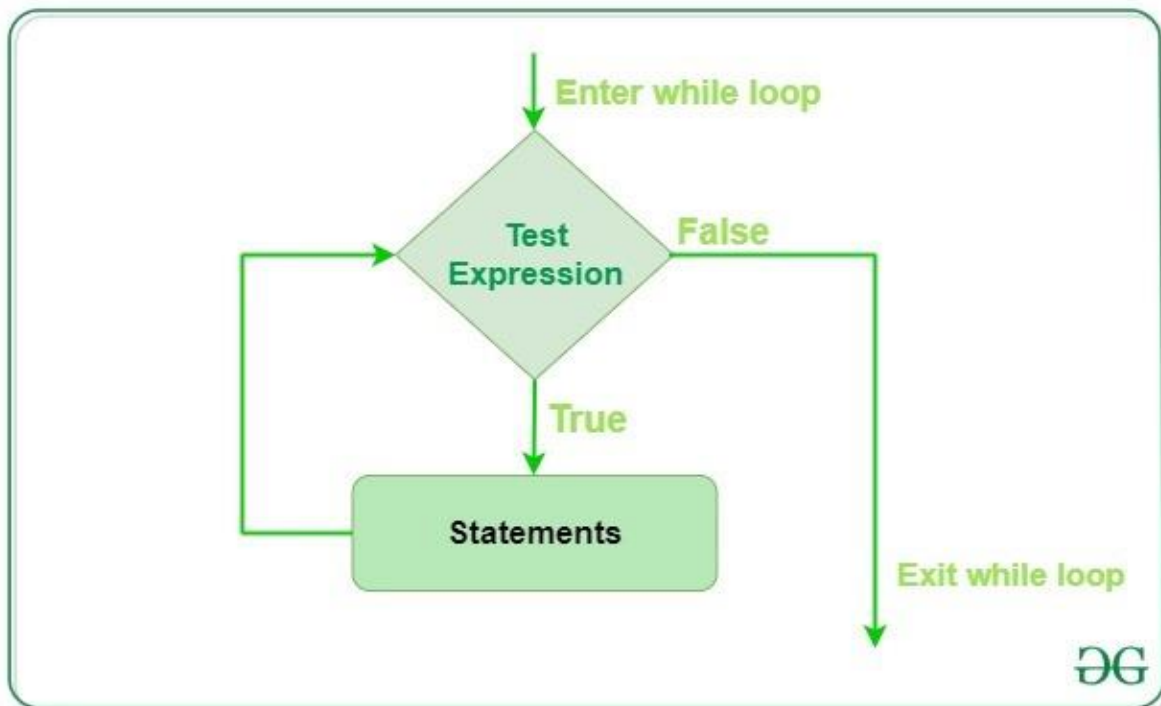
Python support two kinds of loops.

1. **While:** A while loop is used when you have different repetitive statements with a single condition. When the condition gets false, your loop will terminate itself. While loop may have else block too quite often.
2. **For:** The easy and popular loop is for a loop. It is very easy to write and understand because all the parts of loops are written in the same line in for loop. It will reduce the lines of codes as three parts of loops are written in a single line.

## while loop

The while syntax is as follows:

```
while <condition>:  
    statement(s)  
    update_statement
```



Observe this code which displays a series of numbers from 1 to 10.

```

i=1
while i<=10:
    print(i)
    i = i + 1
print("End of loop")

```

## For Loop

The for loop is used to execute the sequence of statements executed in a series. It is the most popular loop among python developers. It is also work in a similar way as while loop is working. Observe the syntax of for loop:

```

for <variable> in <sequence>:
    body loop

```

So here variable is a variable from and then you can take a sequence to execute the statements. The in operator is used to take check the value in the specified sequence.

For the sequence, you can use the range function.

The range() function takes three basic parameters. The first is a start, the second is a stop and the third is a step.

```

range(start,stop,step)
for i in range(1,10,1):
    print(i)

```

In the above code, the range function is used. Hence, the loop starts with 1, stops with 9 and taking one step in every execution. The output will be 1 to 9 numbers only.

## PYTHON PRACTICALS :

CLASS X LIST OF PRACTICALS 2022-23	
SNO	SIMPLE PROGRAMS
1	Display the message "Welcome to Python "
2	Print your School Address
3	Sum of 2 numbers
4	Sum and Average of 3 numbers
5	Area and perimeter of a circle
6	Square and Cube of a Number
7	Area and perimeter of a Rectangle
8	Calculate Percentage after inputting 5 marks

9	Area of a triangle
10	Arithmetic Operations (+, -, *, ?)
11	Calculate Simple Interest
<b>CONDITIONAL STATEMENTS</b>	
12	Check whether a given number is even or odd using if else
13	Largest among two numbers using if else
42	Print day name in words using if elif else ladder
15	Print the grade of a student based on percentage using if elif else ladder after inputting marks in 5 subjects
16	Print a single digit in words using if elif else ladder
17	Design a four function calculator using if elif else ladder
18	Electricity Bill Calculation using if else if ladder
<b>LOOPING STATEMENTS</b>	
19	Print natural numbers upto N
20	Print sum of natural numbers upto N
21	Printing even no.s upto a limit
23	To check whether a number is Armstrong or not
24	To find the reverse of a number
25	Print Fibonacci series up to N
26	Find the Factorial of a number
27	Print Multiplication Table
28	Find the Sum and Average of even and odd numbers from a set of N numbers
29	Find the Largest among N numbers
30	Print the pattern * * * * * *

## DATA SCIENCES

### Python for Data science

Every AI project requires a programming-based model which is trained to produce outcomes. Data Sciences also are heavily dependent on programming language that is capable of processing large amounts of data while applying data science functions. Python is one such language and is mostly used in data science projects.

### Numpy

Numpy, which stands for Numerical Python,

Python library that provides functionality to do the following:

- Create a multidimensional array object (called ndarray or Numpy array).
- Providing tools for working with ndarrays,

### Numpy Arrays

An array in general refers to named group of homogeneous elements

A Numpy array is simply a grid that contains values of the same/homogeneous type.

```
import numpy as np
```

```
list =[1, 2,3,4]
```

```
A1=np.array(list)
```

```
print(a1)
```

Although Numpy Arrays look similar to python Lists.

### Difference between Numpy Array and Python Lists

Lists	Numpy Arrays
Python lists can store any type of data and mixed type of data in them.	Numpy Arrays can store only homogeneous data in them
Lists are part of core Python so no library is needed to create them.	Numpy arrays require Numpy library to be imported first of all that is following statement must be first written in the program before using Ndarrays  Import Numpy as np
Lists size can easily be changed	Numpy arrays cannot be resized directly.
Mathematical functions cannot be applied directly to lists.	Ndarray support vector operations and hence mathematical and statistical can be directly applied to Ndarray elements.

Lists consume more memory than Ndarray.	Ndarrays are faster than lists.
Adding new elements to a list does not create a new lists.	Adding new elements to an Ndarray internally creates anew Ndarray and old ndarray is deleted

## PANDAS

Pandas or Python pandas are python's library for data analysis. Pandas have derived its name from "Panel data system" which is an econometrics term for multi -dimensional, structured data sets.

Pandas is a software library written for the python programming language for data manipulation and analysis, and are a popular choice for data science.

The Pandas library has two primary data structure, **Series** (1-dimensional) and **Data frame** (2-dimensional), that can handle the vast majority of typical use cases in finance, statistics, social science, and many areas of engineering.

```
import pandas as pd
```

Example:

```
import pandas as pd
```

```
mydataset = {
    'cars': ["BMW", "Volvo", "Ford"],
    'passings': [3, 7, 2]
}
```

```
myvar = pd.DataFrame(mydataset)
```

```
print(myvar)
```

## MATPLOTLIB

Matplotlib is a Python library used for Data Visualization. Data Visualization is an essential component of data sciences.

```
import matplotlib as mp1
```

You can create bar-plots, scatter-plots, histograms and a lot more visualizations with Matplotlib.

### Data Visualization

Data Visualization basically refers to the graphical or visual representation of information and data using visual elements like charts, graphs, and maps etc.

For data visualization in python, the Matplotlib library's Pyplot interface is used.

**Pyplot** is a collection of methods within matplotlib library which allows user's to construct 2D plots easily and interactively.

### 1. Line Chart

A line chart or line graph is a type of chart which displays information as a series of data points called 'markers'

A line chart is created using **plot()** function.

### 2. Bar Chart

A bar chart or bar graph is a chart or graph that presents categorical data with rectangular bars with heights or lengths proportional to the values that they represent.

With Pyplot, a bar chart is created using **bar()** and **barh()** functions.

### 3. Scatter Plot

The scatter plot is similar to a line chart, the major difference is that while line graph connects the data points with a line, scatter chart simply plots the data points to show the trend in the data.

With Pyplot, a scatter chart is created using **scatter ()** function.

### 4. Pie Chart

A pie chart is a circular statistical graphic, which is divided into slices to illustrate numerical proportion.

With Pyplot, a pie chart is created using **pie ()** function.

### 5. Histogram Plot

A histogram is a type of graph that provides a visual interpretation of numerical data by indicating the number of data points that lie within a range of values.

With Pyplot, a histogram is created using **hist ()** function.

### 6. BoxPlot Chart

A Box Plot is the visual representation of the statistical five number summary of a given data set.

With Pyplot, a boxplot is created using **boxplot ()** function.

## STATISTICAL LEARNING

Data processing mainly aims at transforming data into a form most suited for an application. There are many statistical techniques used for data processing some basic and commonly used statistical techniques useful for different types of measures.

### MEASURES OF CENTRAL TENDENCY

A measure of central tendency is a single value that attempts to describe a set of data by identifying the central position within that set of data. The most common measures of central tendency are mean, median, and mode.

#### 1. Mean

The measure of central location.

`statistics.mean()`

## 2. Median

Another measure of central location that, unlike the mean is not affected by extremely large or extremely small data values.

`statistics.median()`

## 3. Mode

The data entry that occurs with the greatest frequency.

`statistics.mode()`

## Measures of Variability

Measures of variability refer to the scatter or spread of scores around their central tendency. The measures of variability indicate how the distribution scatters above and below the central tendency. The most common measures of variability are range, variance, and standard deviation.

### Range

The Range is the difference between the lowest and highest values of a given set of values.

`Range=(Max.data entry)-(Min.data entry)`

### Variance

The variance is the average of the squared differences from the mean.

`statistics.variance()`

### Standard Deviation

Standard Deviation is a statistic used to describe the spread of data about the mean, which is found by calculating the positive square root of the variance.

`statistics.stdev()`

## Basic Statistics with python

You can use these functions as

`numpy<function>(<ndarray>)`

or

`np.<function>(<ndarray>)`



Example:

```
import numpy
speed = [99,86,87,88,111,86,103,87,94,78,77,85,86]
x = numpy.mean(speed)
print(x)
output
89.76923076923077
```

## **K-NEAREST NEIGHBOR MODEL**

### **INTRODUCTION**

KNN is a simple, supervised machine learning (ML) algorithm that can be used for classification or regression tasks - and is also frequently used in missing value imputation. It is based on the idea that the observations closest to a given data point are the most "similar" observations in a data set, and we can therefore classify unforeseen points based on the values of the closest existing points. By choosing  $K$ , the user can select the number of nearby observations to use in the algorithm.

### **KNN (K-Nearest Neighbour)**

KNN is a supervised Learning algorithm that classifies a new data point into the target class, counting on the features of its neighbouring data points.

### **KNN modelling works around four parameters:**

- Features: The variables based on which similarity between two points is calculated.
- Distance function: Distance metric to be used for computing similarity between points.
- Neighbourhood( $K$ ): Number of Neighbours to search for
- Scoring function: The function which finds the majority score and class for the query point.

### **Significance of K, The number-of-neighbors/neighborhood-value**

- With much lower values of  $K$ , our predictions become less stable.
- With increase in the neighbourhood value of  $K$ , the predictions become more stable due to clear indication of majority and thus the model is more likely to make more accurate predictions.
- With very high value of  $K$ , the concept of neighbourhood is defeated and increasing number of errors start occurring. This is the stage when underfitting starts happening.
- KNN algorithms follow some methods and techniques to ensure the optimal value of  $K$  so that the results are stable and accuracy prone.

## **Applications of KNN Models**

- For Recommender system
- For Looking for similar documents
- For Text categorisation
- For Detecting frauds
- In Health and Medicine
- For Estimating soil Water parameter

## Practicals

1.

```
import numpy as np
```

```
arr = np.array([1, 2, 3, 4, 5])
```

```
print(arr)
```

2.

```
import numpy as np
```

```
arr = np.array(42)
```

```
print(arr)
```

3.

```
import pandas as pd
```

```
mydataset = {  
    'cars': ["BMW", "Volvo", "Ford"],  
    'passings': [3, 7, 2]  
}
```

```
myvar = pd.DataFrame(mydataset)
```

```
print(myvar)
```

4.

```
import pandas as pd
```

```
a = [1, 7, 2]
```

```
myvar = pd.Series(a)
```

```
print(myvar)
```

5.

```
import pandas as pd
```

```
data = {
```

```
"calories": [420, 380, 390],  
"duration": [50, 40, 45]  
}
```

```
myvar = pd.DataFrame(data)
```

```
print(myvar)
```

6.

```
import statistics  
print(statistics.mean([1, 3, 5, 7, 9, 11, 13]))  
print(statistics.mean([1, 3, 5, 7, 9, 11]))  
print(statistics.mean([-11, 5.5, -3.4, 7.1, -9, 22]))
```

7.

```
import statistics  
print(statistics.median([1, 3, 5, 7, 9, 11, 13]))  
print(statistics.median([1, 3, 5, 7, 9, 11]))  
print(statistics.median([-11, 5.5, -3.4, 7.1, -9, 22]))
```

8.

```
import statistics  
print(statistics.mode([1, 3, 3, 3, 5, 7, 7, 9, 11]))  
print(statistics.mode([1, 1, 3, -5, 7, -9, 11]))  
print(statistics.mode(['red', 'green', 'blue', 'red']))
```

9.

```
import statistics  
print(statistics.stdev([1, 3, 5, 7, 9, 11]))  
print(statistics.stdev([2, 2.5, 1.25, 3.1, 1.75, 2.8]))  
print(statistics.stdev([-11, 5.5, -3.4, 7.1]))  
print(statistics.stdev([1, 30, 50, 100]))
```

10.

```
import statistics  
print(statistics.variance([1, 3, 5, 7, 9, 11]))  
print(statistics.variance([2, 2.5, 1.25, 3.1, 1.75, 2.8]))  
print(statistics.variance([-11, 5.5, -3.4, 7.1]))  
print(statistics.variance([1, 30, 50, 100]))
```

11.

```
import matplotlib.pyplot as plt  
import numpy as np  
xpoints = np.array([1, 2, 6, 8])  
ypoints = np.array([3, 8, 1, 10])  
plt.plot(xpoints, ypoints)  
plt.show()
```

## QUESTIONS

### I. One mark question:

1. A python package which stands for 'Numerical Python' is named and used as \_\_\_\_\_ in Python programs.
2. \_\_\_\_\_ is another name for Numpy arrays.
3. Series is a data structure belonging to python's \_\_\_\_\_ library.
4. The \_\_\_\_\_ is the mathematical average of a set of data value.
5. KNN refers to \_\_\_\_\_.

### II. Two mark questions:

1. What is the significance of K's value in KNN model?
2. What are Numpy arrays?
3. Name the basic data structure of NumPy.
4. What is Median?
5. What is Outlier?

### III. Three marks questions:

1. How are NumPy arrays similar or different from Python lists?
2. What is data visualisation?
3. What is Matplotlib library mainly used for?

### IV. Four marks question

1. What is the difference between Python lists and Numpy Arrays?
2. Explain the applications of KNN Models.

# COMPUTER VISION

## **Introduction to Computer vision**

Computer Vision is a subset of artificial intelligence that makes computers, machines and devices visually enabled by giving them capability to analyse and understand the image captured by camera. The concept of computer vision was first introduced in the 1970s.

## **Applications of Computer vision**

**Facial Recognition:** A facial recognition system is a computer vision-based technology that identifies or verifies or matches a digital image of human face against a database of stored images. Facial recognition is performed in three steps.

- a) Face detection
- b) Face capture
- c) Face match

This can be used in either guest recognition or log maintenance of the visitors. It also finds its application in schools for an attendance system based on facial recognition of students.

**Face Filters:** The modern-day apps like Instagram and snapchat have a lot of features based on the usage of computer vision. The application of face filters is one among them. Through the camera the machine or the algorithm is able to identify the facial dynamics of the person and applies the facial filter selected.

**Image search on search engines:** Image search where you paste an image in the search engine's query box and it returns the most similar images in a fraction of a second. This type of search is called reverse image search. This uses Computer Vision as it compares different features of the input image to the database of images and gives us the search result while at the same time analysing various features of the image.

**Computer Vision in Retail:** The retail field has been one of the fastest growing field and at the same time is using Computer Vision for making the user experience more fruitful. Retailers can use Computer Vision techniques to

- Track customers' movements through stores, analyse navigational routes and detect walking patterns.
- Manage inventory: Through security camera image analysis, a Computer Vision algorithm can generate a very accurate estimate of the items available in the store.
- Analyse the use of shelf space to identify suboptimal configurations and suggest better item placement.

**Self-driving cars:** Computer Vision is the fundamental technology behind developing autonomous vehicles. AI is used for developing on-road versions of hands-free technology. This involves the process of identifying the objects, getting navigational routes and also at the same time environment monitoring.

**Medical Imaging:** It is widely used in medical imaging in the form of many applications such as

- Skin cancer detection
- Surgery simulations
- Diagnosis Aid
- Pneumonia detection

Agriculture: Drones mounted with computer vision technology are being used for crop monitoring. Computer vision systems can monitor animals such as cattle, sheep, pigs or other with cameras

Google Translate App: By using optical character recognition to see the image and augmented reality to overlay an accurate translation, Google translate app is a convenient tool that uses Computer Vision to read signs in a foreign language and to translate it to your preferred language.

## Questions

### Fill in the blanks

1. Emoji Scavenger Hunt game is based on \_\_\_\_\_ technology.
2. A \_\_\_\_\_ is a computer vision-based technology that identifies or verifies or matches a digital image of a human face against a database of stored face image.
3. \_\_\_\_\_ refers to a search where the search query is formed using a pasted image and the search engine looks for matching or similar images from around the web.
4. Google reverse image search facility is officially known as \_\_\_\_\_
5. \_\_\_\_\_ technology makes computers, machines and devices analyse and understand the images captured by camera.

### Short Answer Questions

1. What is computer vision?
2. What are some applications of computer vision?
3. What is reverse image search?

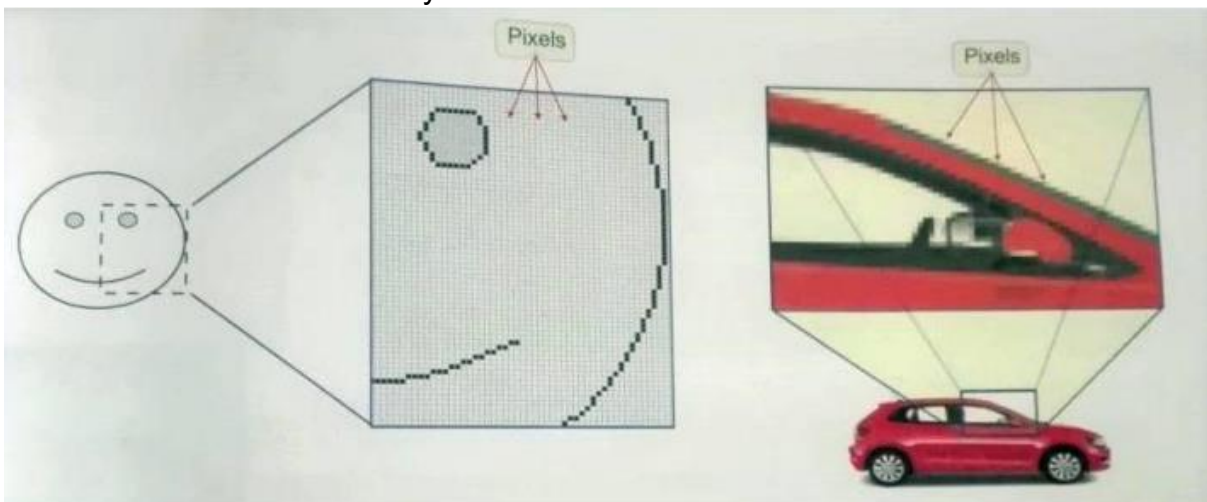
### Answers

1. CV
2. Facial recognition
3. Reverse Image Search
4. Google Search by Image
5. CV

## **Computer vision concepts**

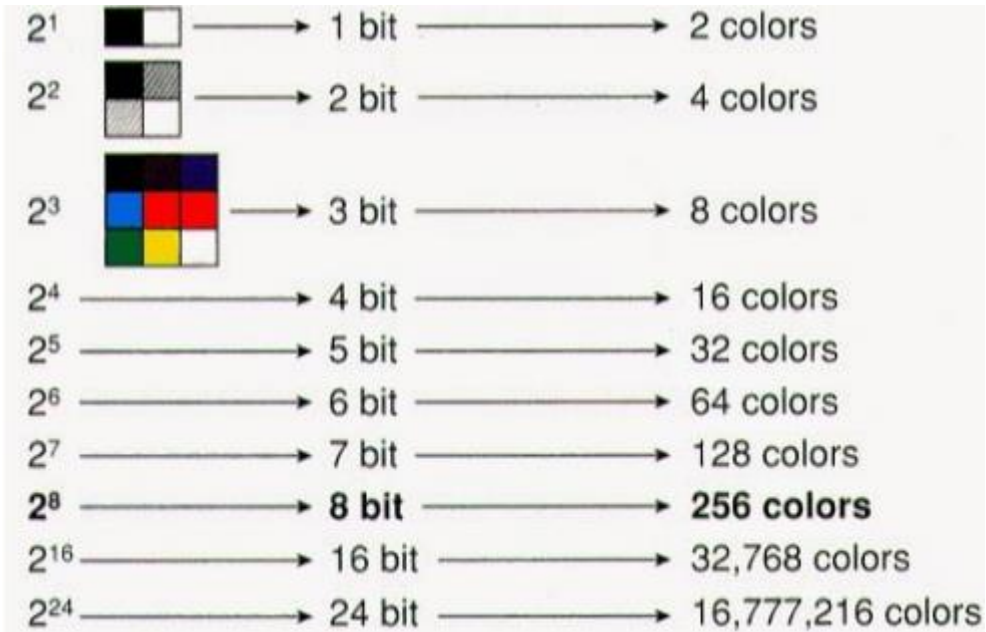
### Digital Images used with C

1. Pixel: - A pixel represents the smallest piece of the screen that can be controlled individually in terms of colour and intensity.

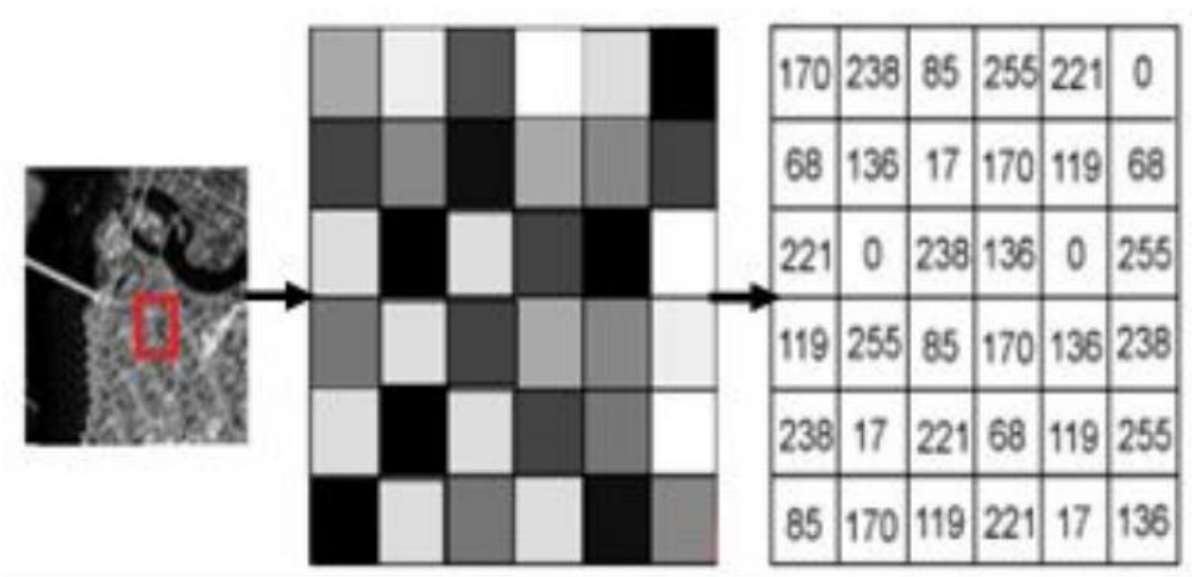


2. Pixel Colour and Intensity: - Combination of three different colour signals- Red, Green, Blue (RGB) ◦ White - (255,255,255) ◦ Black - (0,0,0)

3. Resolution: - It refers to the quality and size of an image in terms of the number of pixels it contains, typically as 'width x height'. ◦ Eg:- 100 \* 100 pixel image has a total of 10000 pixels.
4. Colour Depth / Pixel Value: - The amount of information that is stored about a pixel determines its colour depth (pixel value), which controls how precisely the pixel's colour can be specified.



5. Grayscale Images:- It is an image in which the only colours are shades of gray



6. RGB Images (Coloured Images): - It is a coloured image that is formed by the three-colour information stored for each pixel of a digital image



Original Image



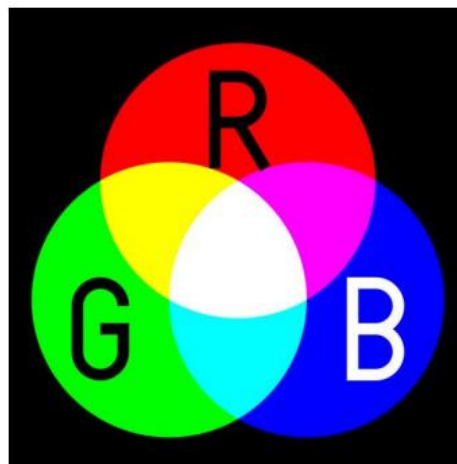
Red Channel



Green Channel

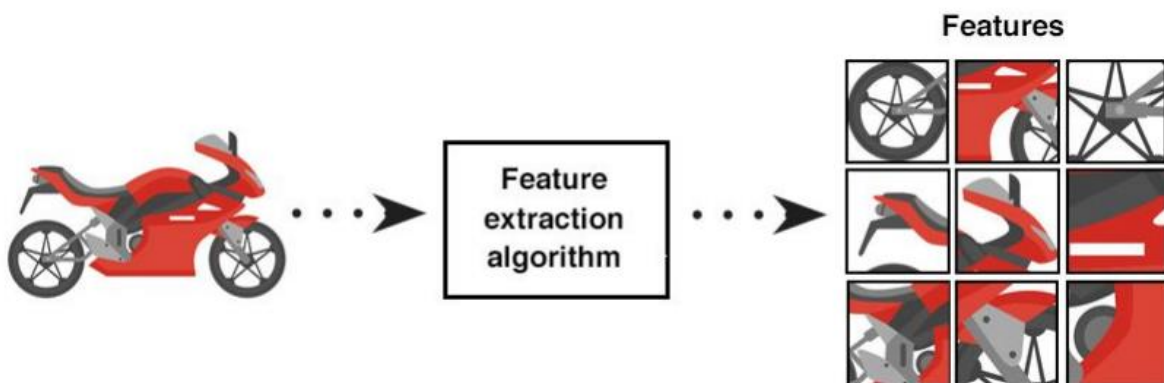


Blue Channel



### Image Features:

An image feature is a measurable piece of data in image which is unique to this specific object, such as a distinct colour, specific shape or an image segment



### Questions & Answers

Answer the following questions (1 mark)

1. A ..... represents the smallest piece of the screen that can be controlled individually in terms of colour and intensity.

**Ans: Pixel**



2. Image ..... refers to the quality and size of an image in terms of the number of pixels it contains, typically as 'width x height'.

**Ans: Resolution**

3. RGB value ..... represents black colour.

**Ans: (0,0,0)**

4. RGB value .....represents white colour.

**Ans: (255,255,255)**

5. An ..... is a measurable piece of data in your image which is unique to this specific object, such as a distinct colour, specific shape or an image segment.

**Ans: Image feature**

### **Answer the following questions (2 mark)**

6. What is the difference between grayscale and RGB images?

Ans: A grayscale image is an image in which the only colours are shades of gray. An RGB image is a coloured image that is formed by the three-colour information (red, green, blue) stored for each pixel of a digital image.

### **Answer the following questions(3 mark)**

7. What do you understand by image features? How are these useful in computer vision?

Ans: An image feature is a measurable piece of data in an image which is unique to this specific object, such as a distinct colour, specific shape or an image segment.

Using image features, the CV algorithms identify and create classes of objects. Using these classes, various CV tasks take place.

## **Introduction to OpenCV, Image processing**

### **OpenCV**

OpenCV or Open-Source Computer Vision Library is that tool which helps a computer extract these features from the images. It is used for all kinds of images and video processing and analysis. It is capable of processing images and videos to identify objects, faces, or even handwriting.

To install OpenCV library, open anaconda prompt and then write the following command:

```
pip install opencv-python
```

In order to work with OpenCV in Python programs or scripts, import the module first.

```
import cv2 # import OpenCV
```

```
from matplotlib import pyplot as plt # import matplotlib
```

```
import numpy as np # import numpy
```

We import numpy as we want to store the pixel values in the numpy array We import matplotlib to allow us to display our images on the Jupyter notebook itself

## Programs using OpenCV

### 1. Write a program to load an image

```
img = cv2.imread('Images/man.jpg') #Load the image into memory
plt.imshow(img)
plt.title('BlueMan')
plt.axis('on')
plt.show()
```

### 2. Write a program to load an image in RGB

```
img = cv2.imread('Images/man.jpg') #Load the image file into memory
plt.imshow(cv2.cvtColor(img, cv2.COLOR_BGR2RGB))
plt.title('man')
plt.axis('off')
plt.show()
```

### 3. Write a program to read an image as a grayscale image

```
# the number zero opens the image as a grayscale image
img = cv2.imread('Images/man.jpg',0)
#cmap specifies color mapping, gray in this case.
plt.imshow(img, cmap = 'gray', interpolation = 'bicubic')
plt.title('man')
plt.axis('off')
plt.show()
```

### 4. Write a program to display the axis to find the region of interest(ROI)

```
img = cv2.imread('Images/man.jpg')
plt.imshow(cv2.cvtColor(img, cv2.COLOR_BGR2RGB))
plt.title('man')
plt.axis('on')
plt.show()
```

### 5. Write a program to crop the image

```
# Extract a square that focuses on the man's face
# Remember, your current image size is 3967 x 2977
```

```

roi = img[1500:2500,1000:2000] #img[range of y, range of x]
plt.imshow(cv2.cvtColor(roi, cv2.COLOR_BGR2RGB))
plt.title('man')
plt.axis('off')
plt.show()

```

## 6. Write a program to resize the image maintaining aspect ratio

```

# fixed resizing and distort aspect ratio so let's resize the width
# to be 300px but compute the new height based on the aspect ratio
# Current image size is 3967 x 2977

img = cv2.imread('Images/man.jpg')

resized=cv2.resize(img, (int(img.shape[1]/10),int(img.shape[0]/10)))

plt.imshow(cv2.cvtColor(resized, cv2.COLOR_BGR2RGB))

plt.title('man')

plt.axis('off')

plt.show()

print(resized.shape)

cv2.imwrite('rem_man.jpg',resized)#save the image

```

## CONVOLUTION OPERATOR AND CNN

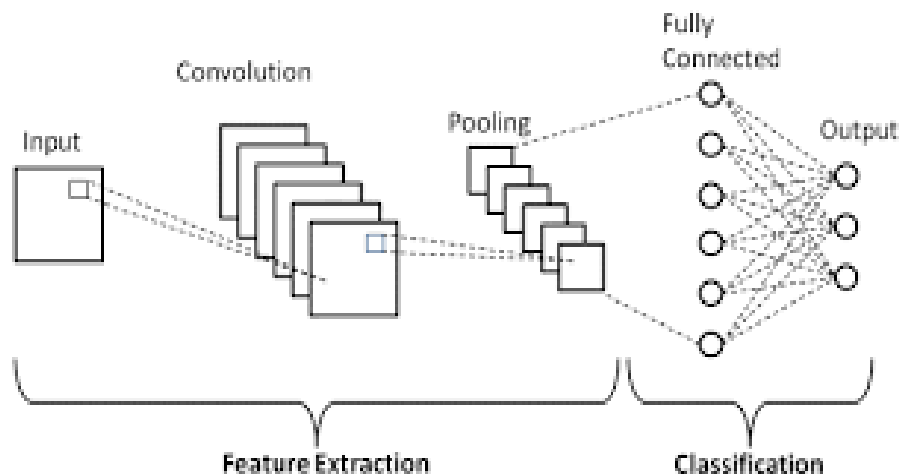
### Introduction to Convolutional Neural Network

1. A convolutional neural network (CNN) is a **type of artificial neural network used in image recognition and processing that is specifically designed to process pixel data.**
2. The term “convolutional” refers to a mathematical function that is created by integrating two different functions. It usually involves multiplying various elements to combine them into a coherent whole.
3. Convolution describes how the shape of one function is influenced by another function.
4. **Pooling** refers to the down-sampling of the data by bringing the overall dimensions of the image.
5. The image size can be reduced with the help of **Feature Map.**
6. The processing at the hidden layer is carried out as **Sum of weighted inputs+ activation function+ hidden rules.**
7. In convolution operation, the **kernel** is a matrix of values who decides the transformation effect of the image.
8. In the **convolution layer** pixel by pixel scanning of the image takes place.

### CNN's Basic Architecture

- A CNN architecture consists of two key components:

- A convolution tool that separates and identifies the distinct features of an image for analysis in a process known as Feature Extraction
- A fully connected layer that takes the output of the convolution process and predicts the image's class based on the features retrieved earlier.
- The CNN is made up of three types of layers: convolutional layers, pooling layers, and fully-connected (FC) layers.



## Layers in Convolutional Neural Network

A convolution neural network has multiple hidden layers that help in extracting information from an image. The four important layers in CNN are:

1. Convolutional layer
2. ReLU layer
3. Pooling layer
4. Fully connected layer

## Convolutional Layer

The convolutional layer is where the action begins. The convolutional layer is designed to discover image features.

Convolutional Layer is the backbone of CNN working model. In this layer, pixel by pixel scanning takes place of the images and then it creates a feature map to define future classification

As per its name, this layer uses convolution operation on the images with the help of several kernels to produce several features such as edges, colour, gradient orientation, etc. This way collected outputs (features) are gathered in the form of Feature Map or the Activation Map.

There's several uses we derive from the feature map:

- We reduce the image size so that it can be processed more efficiently.
- We only focus on the features of the image that can help us in processing the image further.

## Rectified Linear Unit layer (aka ReLu)

This layer is considered as an extension of a convolutional layer. The goal of ReLu is to increase the image's non-linearity. It is the technique of removing excess fat from a picture in order to improve feature extraction.

## Pooling layer

The pooling layer is used to minimize the number of input parameters, i.e. it focuses on the most important aspects of the information obtained.

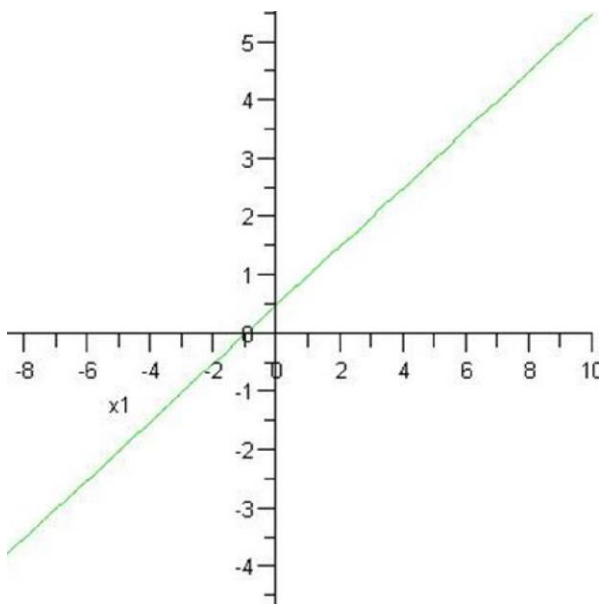
## Connected layer

It is a standard feed-forward neural network. It's the last straight line before the finish line, where everything is already visible. It's only a matter of time until the results are confirmed.

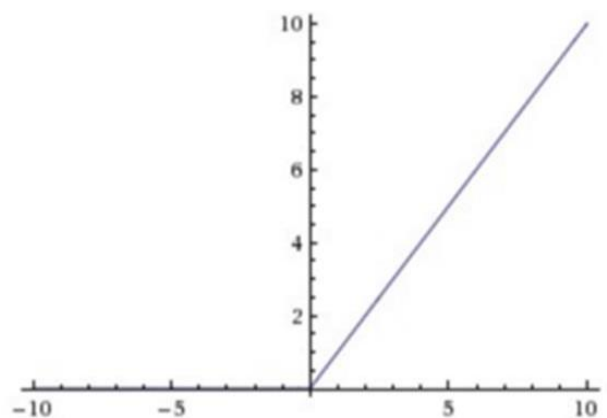
## Rectified Linear Unit Layer(ReLU)

The next layer in the Convolution Neural Network is the Rectified Linear Unit function or the ReLU layer. After we get the feature map, it is then passed onto the ReLU layer. This layer simply gets rid of all the negative numbers in the feature map and lets the positive number stay as it is.

The process of passing it to the ReLU layer introduces non – linearity in the feature map. Let us see it through a graph.



we see the two graphs side by side, the one on the left is a linear graph. This graph

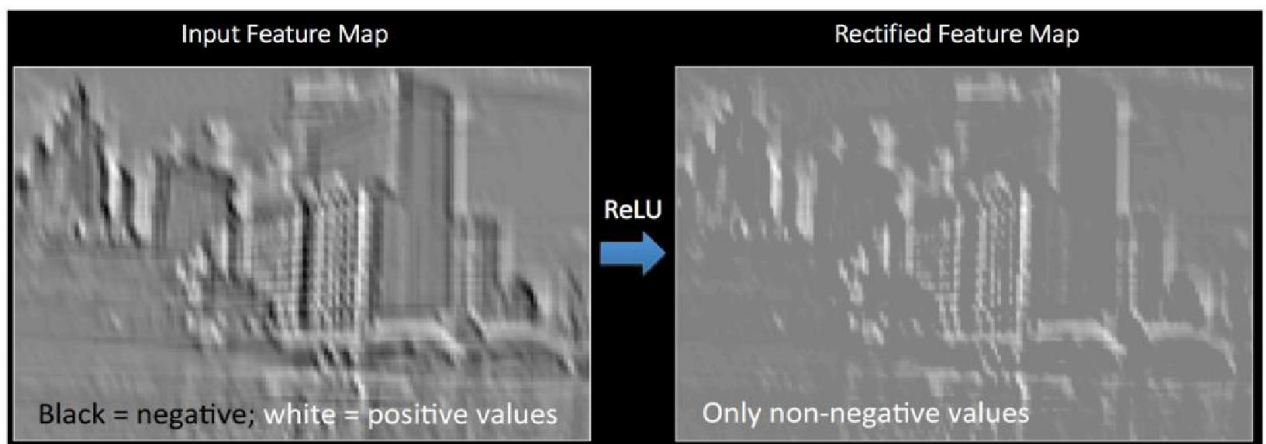


$$\text{Output} = \text{Max}(\text{zero}, \text{Input})$$

when passed through the ReLU layer, gives the one on the right. The ReLU graph starts with a horizontal straight line and then increases linearly as it reaches a positive number.

Now the question arises, why do we pass the feature map to the ReLU layer? it is to make the colour change more obvious and more abrupt

As



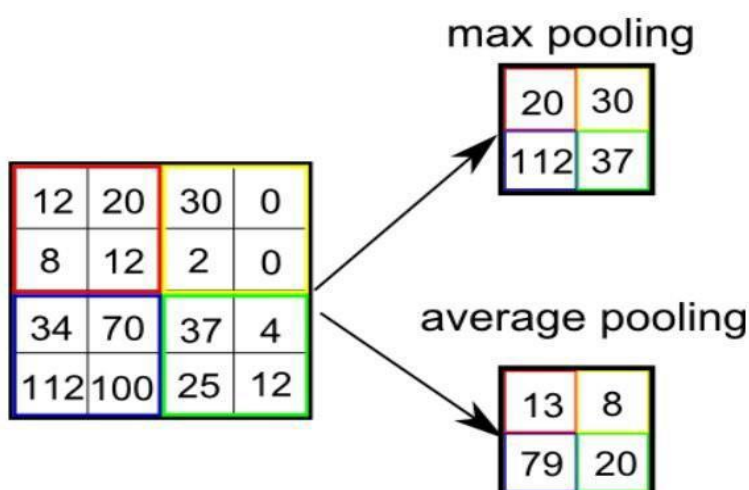
shown in the above convolved image, there is a smooth grey gradient change from black to white. After applying the ReLU function, we can see a more abrupt change in colour which makes the edges more obvious which acts as a better feature for the further layers in a CNN as it enhances the activation layer

## Pooling Layer

The Pooling layer is responsible for reducing the spatial size of the Convolved Feature while still retaining the important features.

There are two types of pooling which can be performed on an image.

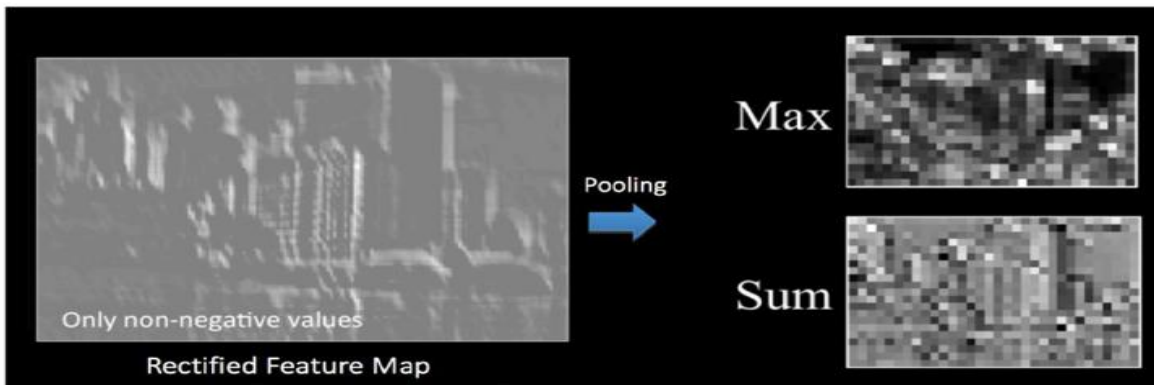
- 1) Max Pooling: Max Pooling returns the maximum value from the portion of the image covered by the Kernel.
- 2) Average Pooling: Average Pooling returns the average value from the portion of the image covered by the Kernel.



The pooling layer is an important layer in the CNN as it performs a series of tasks which are as follows :

- 1) Makes the image smaller and more manageable

2) Makes the image more resistant to small transformations, distortions and translations in the input image.



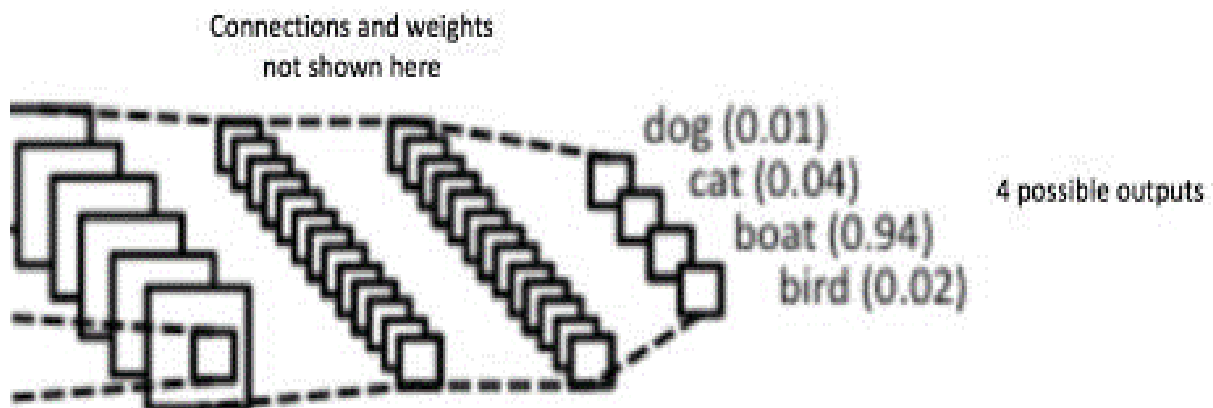
A small difference in input image will create very similar pooled image.



## Fully Connected Layer

The final layer in the CNN is the Fully Connected Layer (FCP). The objective of a fully connected layer is to take the results of the convolution/pooling process and use them to classify the image into a label (in a simple classification example).

The output of convolution/pooling is flattened into a single vector of values, each representing a probability that a certain feature belongs to a label. For example, if the image is of a cat, features representing things like whiskers or fur should have high probabilities for the label "ca



## Testing CNN

Now let us see how this comes into practice. To see that, go to the link

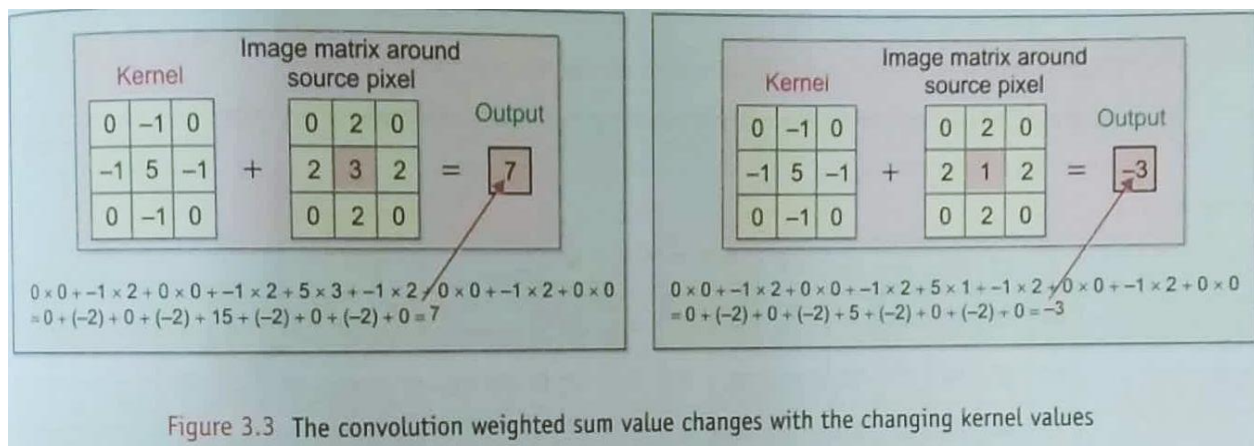
<http://scs.ryerson.ca/~aharley/vis/conv/flat.html>

This is an online application of classifying different numbers. We need to analyse the different layers in the application on the basis of the CNN

## What is a kernel?

In Convolutional neural network, the kernel is nothing but a filter that is used to extract the features from the images. A Kernel is a matrix used for applying various effects on image through convolution such as for blurring, sharpening, embossing, edge detection and more

In Image processing, the Kernel's value depends upon the type of effect being applied. The output of the convolution process changes with the changing kernel values(Fig 3.3).For example , for sharpening the image, the kernel values will be different from the blurring kernel. And accordingly the same picture will look different with one thing common that the same effect will be applied to each pixel of the image



## OBJECTIVE TYPE QUESTIONS

- \_\_\_\_\_ is the process of transforming an image by applying a similar effect through a special array namely kernel over each pixel and it's local neighbours across the entire image.
  - Image flattening
  - Pooling
  - Convolution**
  - ReLU
- In convolution operation, the \_\_\_\_\_ is a matrix of values whose size and values determine the transformation effect of the image through convolution process.
  - ReLU
  - Kernel**
  - Pooling
  - None of these
- Which of the following is not a layer of the CNN architecture?
  - Convolutional layer
  - ReLU layer
  - Pooling layer
  - Flattening layer**



4) In a CNN, which of these layers use convolution operation on the images with the help of several kernels?

- a) **Convolutional layer**
- b) ReLU layer
- b) c) Pooling layer
- d) Fully connected

5) In CNN, which of these layers uses rectified linear activation function?

- a) Full connected
- b) **ReLU layer**
- c) Convolutional layer
- d) Pooling layer

6) Which of the pooling types are used mostly in the pooling layer?

- a) **Maximum pooling**
- b) **Average pooling**
- c) Minimum pooling
- d) Median pooling

7) In a CNN, which of these layers performs classification based on the features by previous layer by classifying the images based on their labels assigning after image flattening?

- a) Pooling layer
- b) Convolutional layer
- c) ReLU layer
- d) **Fully connected**

### **SHORT ANSWER QUESTIONS**

#### **1. What is ReLU? What does it do?**

Ans) ReLU means Rectified Linear activation function. It is a piecewise linear function that only outputs the input directly if it is positive, otherwise it removes the inputs falling in negative range. This helps in sharpening the edges of images.

#### **2. What is pooling? How is it performed?**

Ans) Pooling refers to the down-sampling of the data by bringing the overall dimensions of the images. Mostly two types of pooling takes place: (i) Maximum pooling (where the maximum value of a pool is taken) and (ii) Average pooling (where the average of all values of a pool is taken).

#### **3. What is Convolutional layer?**

Ans) Convolutional layer uses convolution operation on the images with the help of several kernels to produce several features such as edges, colour, gradient orientation, etc

#### **4. What is the objective of fully connected layer?**

Ans) The final layer in the CNN is the Fully Connected Layer. The objective of a Fully connected layer is to take the results of the convolution/pooling process and use them to classify the image into a label (in a simple classification example)

#### **5 Define the term 'Kernel'?**

Ans) A Kernel is a matrix used for applying various effects on image through convolution such as for blurring, sharpening, embossing, edge detection and more. In Convolutional neural network, the kernel is nothing but a filter that is used to extract the features from the images

## PRACTICAL PROGRAMS

### PROGRAM NO-1

#### Python Basics-1

**AIM-** Write a Python program to print the following string in a specific format.

```
Twinkle, twinkle, little star,  
    How I wonder what you are!  
        Up above the world so high,  
        Like a diamond in the sky.  
Twinkle, twinkle, little star,  
    How I wonder what you are!
```

#### SOURCE CODE-

```
print("Twinkle, twinkle, little star, \n\tHow I wonder what you are! \n\t\tUp  
above the world so high, \n\t\t\tLike a diamond in the sky. \nTwinkle, twinkle,  
little star, \n\tHow I wonder what you are!")
```

#### OUTPUT-

```
Twinkle, twinkle, little star,  
    How I wonder what you are!  
        Up above the world so high,  
        Like a diamond in the sky.  
Twinkle, twinkle, little star,  
    How I wonder what you are!
```

**RESULT-** The source code is executed successfully and the output was verified.

## PROGRAM NO-2

### Python Basics-2

**AIM-** Write a Python program to print 5 lines about yourself using print() function.

#### SOURCE CODE-

```
#Project - 1 Write 5 lines about your self
a = input("Write your name:")
b = int(input("Write your class:"))
c = int(input("Write your roll no.:"))
d= input("Write your father's name:")
e = input("Write your hobbies:")
print("Hello World")
print("1. My name is ",a)
print("2. I'm studying in class ",b)
print("4. My roll no. is ",c)
print("5. My Father's name is ",d)
print("6. My hobbies are ",e)
|
```

#### OUTPUT-

```
Write your name:Pradeep Kumar
Write your class:10
Write your roll no.:5
Write your father's name:Kamlesh Kumar
Write your hobbies:Reading
Hello World
1. My name is Pradeep Kumar
2. I'm studying in class 10
4. My roll no. is 5
5. My Father's name is Kamlesh Kumar
6. My hobbies are Reading
... |
```

**RESULT-** The source code is executed successfully and the output was verified.

## PROGRAM NO-3

### Python Basics-3

**AIM-** Write a program to make a simple calculator.

#### SOURCE CODE-

```
# Python program for simple calculator

# Function to add two numbers
def add(num1, num2):
    return num1 + num2
# Function to subtract two numbers
def subtract(num1, num2):
    return num1 - num2

# Function to multiply two numbers
def multiply(num1, num2):
    return num1 * num2
# Function to divide two numbers
def divide(num1, num2):
    return num1 / num2

print("Please select operation -\n" \
      "1. Add\n" \
      "2. Subtract\n" \
      "3. Multiply\n" \
      "4. Divide\n")

# Take input from the user
select = int(input("Select operations form 1, 2, 3, 4 :"))

number_1 = int(input("Enter first number: "))
number_2 = int(input("Enter second number: "))

if select == 1:
    print(number_1, "+", number_2, "=",
          add(number_1, number_2))
```

```

elif select == 2:
    print(number_1, "-", number_2, "=",
          subtract(number_1, number_2))
elif select == 3:
    print(number_1, "*", number_2, "=",
          multiply(number_1, number_2))
elif select == 4:
    print(number_1, "/", number_2, "=",
          divide(number_1, number_2))

else:
    print("Invalid input")

```

## OUTPUT-

```

Please select operation -
1. Add
2. Subtract
3. Multiply
4. Divide

Select operations form 1, 2, 3, 4 :4
Enter first number: 21
Enter second number: 25
21 / 25 = 0.84
>>> |

```

**RESULT-** The source code is executed successfully and the output was verified.



## PROGRAM NO-4

### Python Basics-4

**AIM-** Write a python program which can solve a quadratic equation.

**Formula:** Let  $ax^2 + bx + c = 0$  is a quadratic equation where a, b and c are real and  $a \neq 0$ , then Quadratic formula is

$$x = \frac{-b \pm \sqrt{b^2 - 2ac}}{2a}$$

#### SOURCE CODE-

```
# Python program to find roots of quadratic equation
import math

# function for finding roots
def equationroots( a, b, c):

    # calculating discriminant using formula
    dis = b * b - 4 * a * c
    sqrt_val = math.sqrt(abs(dis))

    # checking condition for discriminant
    if dis > 0:

        print(" real and different roots ")
        print((-b + sqrt_val)/(2 * a))
        print((-b - sqrt_val)/(2 * a))

    elif dis == 0:
        print(" real and same roots")
        print(-b / (2 * a))

    # when discriminant is less than 0
    else:
        print("Complex Roots")
        print(- b / (2 * a), " + i", sqrt_val)
        print(- b / (2 * a), " - i", sqrt_val)
```

```
# Driver Program
a = int(input('Enter the value of a = '))
b = int(input('Enter the value of b = '))
c = int(input('Enter the value of c = '))

# If a is 0, then incorrect equation
if a == 0:
    print("Input correct quadratic equation")

else:
    equationroots(a, b, c)
```

### OUTPUT-

```
>>>
Enter the value of a = 2
Enter the value of b = -5
Enter the value of c = 3
real and different roots
1.5
1.0
```

**RESULT-** The source code is executed successfully and the output was verified.

## PROGRAM NO-5

### Python Basics-5

**AIM-** A tours and travels company charges their customer as per following criteria according to customer category.

Category Charges

A	18
B	15
C	12
D	10
Others	20

#### SOURCE CODE-

```
def cust_fare():
    ctype = input('Enter Customer Type: ')
    dist = int(input('Enter distance = '))
    if ctype == 'A':
        ch = 18
    elif ctype == 'B':
        ch = 15
    elif ctype == 'C':
        ch = 12
    elif ctype == 'D':
        ch = 10
    else:
        ch = 20
    fare = dist*ch
    print('Total Amount = ', fare*2)
```

```
cust_fare()
```

#### OUTPUT-

```
>>>
Enter Customer Type: c
Enter distance = 125
Total Amount = 5000
>>> |
```

**RESULT-** The source code is executed successfully and the output was verified.



## PROGRAM NO-6

### LISTS AND ITS OPERATIONS

**AIM-** Write a Python program:-

1. To declare a list as **num = [10, 30, 40, 20, 50]** and print it.
2. To sort the list **num** in Ascending and the Descending order in Python.
3. To create a list as **List1 = ['Hello', 10, 'world', 20]** and iterate in reverse order.
4. To remove an element of **List1** using **List1.pop()** .
5. To add an element to a **List1** using **List1.append()**.

#### **SOURCE CODE-**

```
# 1. List of integers num
num = [10, 30, 40, 20, 50]
print ("The num list :", num)

# 2. Sort the list num in Ascending order
num.sort()
print ("the list num in Ascending order: ", num)

#Sort the list num in Descending order
num.sort(reverse=True)
print ("The list num in decending order: ", num)

#3. Create list List1 and iterate
List1 = ['Hello', 10, 'world', 20]
print("The List1 :-", List1)
# iterate the list
List1 = List1[::-1]

# Print the list
print ("List1 in reverse order: ", List1)

#4. Removing elements
List1.pop() ;
# Printing list after removing
print("list elements after removing from List1: ", List1)

#5. adding elements to List1
List1.append(50)
List1.append("Chennai")
# Printing list after adding
print("list elements after adding to List1: ", List1)
```

## OUTPUT-

```
The num list : [10, 30, 40, 20, 50]
the list num in Ascending order: [10, 20, 30, 40, 50]
The list num in decending order: [50, 40, 30, 20, 10]
The List1 :- ['Hello', 10, 'world', 20]
List1 in reverse order: [20, 'world', 10, 'Hello']
list elements after removing from List1: [20, 'world', 10]
list elements after adding to List1: [20, 'world', 10, 50, 'Chennai']
>>> |
```

**RESULT-** The source code is executed successfully and the output was verified.

**PROGRAM NO-7**  
**DATA SCIENCE**  
**Data Visualization Tools**

**AIM-** Write a short note about five essential plots that can help in data visualization and write a Python program to show each.

**Introduction:** Data visualization is the process of turning your data into graphical representations that communicate logical relationships and lead to more informed decision-making. In short, data visualization is the representation of data in a graphical or pictorial format.

There are five essential plots that we need to know well for basic data visualization.

- Line Plot
- Bar Chart
- Histogram Plot
- Scatter Plot
- Pie Chart

1. Line Plot:

- A line plot is used to show observations gathered at regular intervals.
- The x-axis shows the regular interval, such as time.
- The Y- axis shows the observations.
- A line plot can be built by calling the plot() function and passing the X-axis data for the regular interval, and Y – axis for the observations.

```
# code to create a line plot  
pyplot.plot(x, y)
```

2. Bar Plot:

- A bar chart presents relative quantities for multiple categories.
- The x-axis shows the categories that are spaced evenly.
- The Y- axis shows the quantity for each category and is drawn as a bar from the baseline to the required level on the Y-axis.
- A bar chart can be built by calling the bar() function and passing the category names for the X-axis and the quantities for the Y – axis.

3. Histogram Plot

- Histogram plots are used for summarizing the distribution of a data sample.
- The x-axis shows distinct bins or intervals for the observation.
- The Y- axis shows the frequency or tally of the number of observations in the dataset that has assigned to each bin.
- A Histogram plot can be designed by calling the hist() function and passing a list or array that shows the data sample.

```
# code to create a histogram plot  
pyplot.hist(x, y)
```

4. Scatter Plot:

- A scatter plot can be designed by calling the scatter() function and passing a list or array that shows the data sample.

```
# code to create a scatter plot
pyplot. Scatter(x, y)
```

#### 5. Pie Chart

- A Pie Chart is a circular statistical plot that can display only one series of data.
- The area of the chart is the total percentage of the given data. The area of slices of the pie represents the percentage of the parts of the data
- # code to create a pie plot  
pyplot.pie(values, labels = Names)

#### SOURCE CODE-

```
# importing the required libraries
import matplotlib.pyplot as plt
import numpy as np

# define data values
x = np.array([1, 2, 3, 4]) # X-axis points
y = x*2 # Y-axis points

plt.plot(x, y) # Plot the chart
plt.show() # display

# creating the dataset
data = {'C':20, 'C++':15, 'Java':30,
        'Python':35}
courses = list(data.keys())
values = list(data.values())

fig = plt.figure(figsize = (10, 5))

# creating the bar plot
plt.bar(courses, values, color = 'maroon',
        width = 0.4)
```

```
plt.xlabel("Courses offered")
plt.ylabel("No. of students enrolled")
plt.title("Students enrolled in different courses")
plt.show()
```

```
# Creating dataset
```

```
a = np.array([22, 87, 5, 43, 56,
              73, 55, 54, 11,
              20, 51, 5, 79, 31,
              27])
```

```
# Creating histogram
```

```
fig, ax = plt.subplots(figsize=(10, 7))
ax.hist(a, bins = [0, 25, 50, 75, 100])
```

```
# Show plot
```

```
plt.show()
```

```
x = [5, 7, 8, 7, 2, 17, 2, 9,
     4, 11, 12, 9, 6]
```

```
y = [99, 86, 87, 88, 100, 86,
     103, 87, 94, 78, 77, 85, 86]
```

```
plt.scatter(x, y, c = "blue")
```

```
# To show the plot
```

```
plt.show()
```

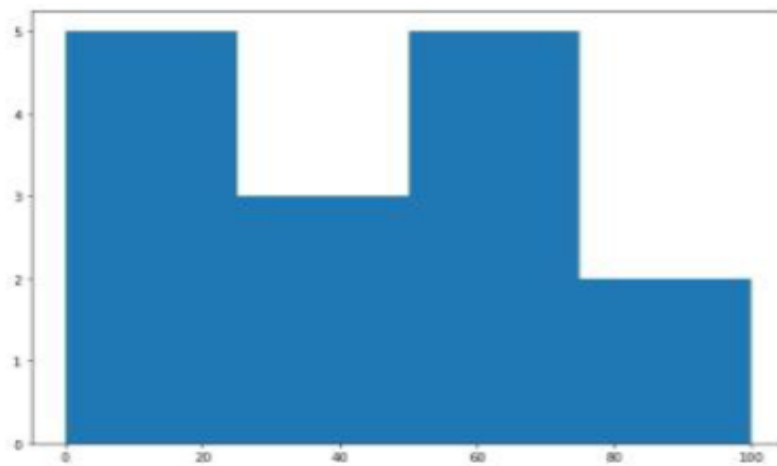
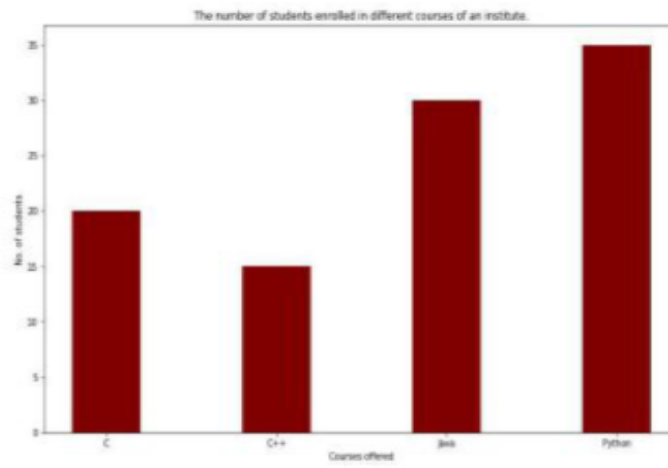
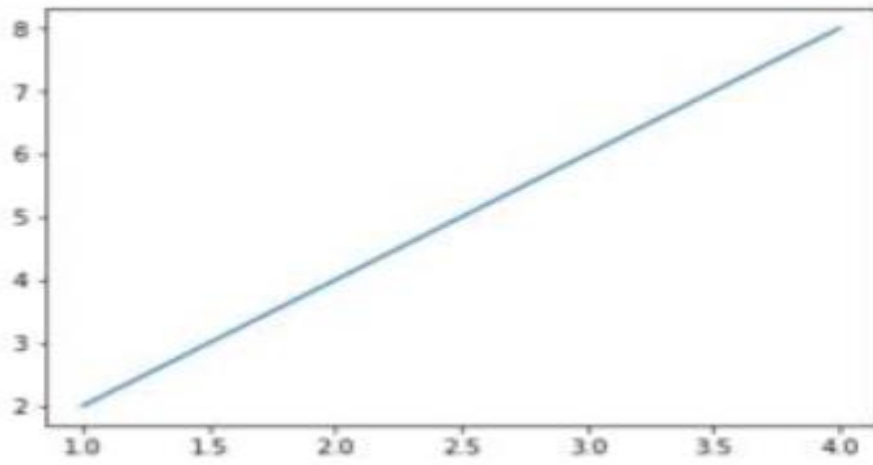
```
values=[12,45,60,46,70]
```

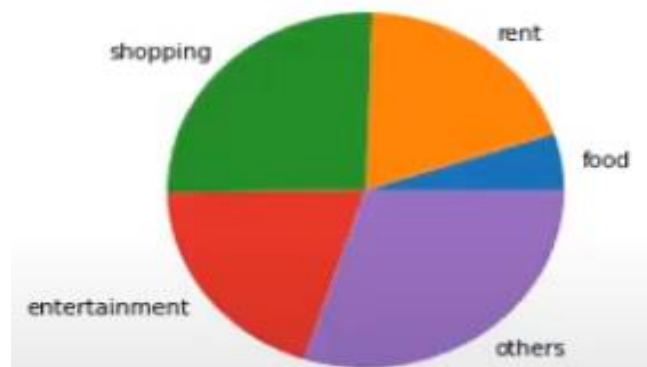
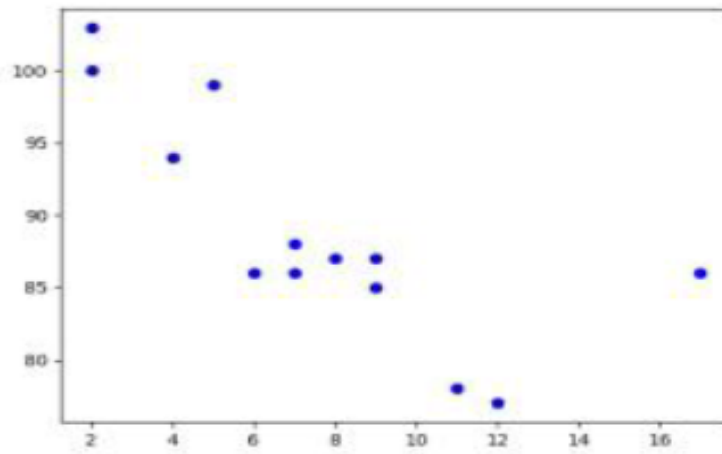
```
Necessity=['food', 'rent', 'shopping', 'entertainment', 'others']
```

```
plt.pie(values, labels=Necessity)
```

```
plt.show()
```

## OUTPUT-





**RESULT-** The source code is executed successfully and the output was verified.

## PROGRAM NO-8

### INTRODUCTION TO COMPUTER VISION

**AIM-** Write a Python program

- To read and display an image using OpenCV in Google Colab.
- To display the height and width of an input image.
- To convert BGR format of OpenCV to RGB format.

#### Introduction:

**Computer Vision** Computer vision is a field/domain of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs — and take actions or make recommendations based on that information.

OpenCV-Python is a library of Python bindings designed to solve computer vision problems. Python is a general purpose programming language started by Guido van Rossum that became very popular very quickly, mainly because of its simplicity and code readability. It enables the programmer to express ideas in fewer lines of code without reducing readability. OpenCV was started at Intel in 1999 by Gary Bradsky, and the first release came out in 2000. Vadim Pisarevsky joined Gary Bradsky to manage Intel's Russian software OpenCV team. In 2005, OpenCV was used on Stanley, the vehicle that won the 2005 DARPA Grand Challenge.

#### SOURCE CODE-

```
# Importing the OpenCV library
import cv2
# Importing the matplotlib library
import matplotlib.pyplot as plt

# Reading the image using imread() function
image = cv2.imread('/road.jpg')
# Displaying the image using imshow() function
plt.imshow(image)

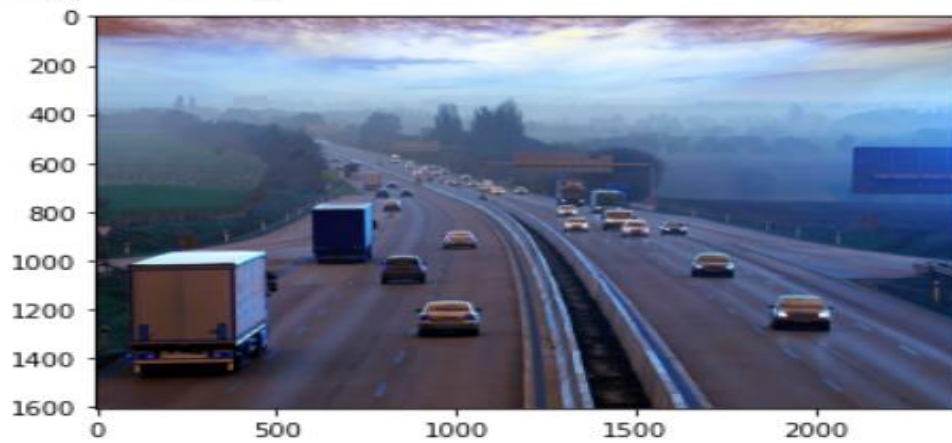
# Extracting the height and width of an image
h, w = image.shape[:2]
# Displaying the height and width
print("Height = {}, Width = {}".format(h, w))

# Converting the image to RGB format using cvtColor() function
imgrgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
plt.imshow(imgrgb), plt.title("RGB FROMAT of given Image")
# Extracting the height and width of an image
h, w = imgrgb.shape[:2]
# Displaying the height and width
print("Height = {}, Width = {}".format(h, w))
```



## OUTPUT-

Height = 1603, Width = 2400



Height = 1603, Width = 2400

RGB FROMAT of given Image



**RESULT-** The source code is executed successfully and the output was verified.

## PROGRAM NO-9

### COMMON IMAGE MANIPULATION USING OpenCV

**AIM-** Write a Python program

- a. To resize the image using `resize()`.
- b. To display the region of interest of an image.
- c. To rotate an image.

#### **SOURCE CODE-**

```
# Importing the OpenCV library
import cv2
# Importing the matplotlib library
import matplotlib.pyplot as plt

# Reading the image using imread() function
image = cv2.imread('/road.jpg')
# Displaying the image using imshow() function
plt.imshow(image),plt.title("ORIGINAL IMAGE")

# Extracting the height and width of an image
h, w = image.shape[:2]
# Displaying the height and width
print("Height = {}, Width = {}".format(h, w))

# resize() function takes 2 parameters,
# the image and the dimensions
resize = cv2.resize(image, (800, 800))
plt.imshow(resize),plt.title("RESIZED IMAGE")

# We will calculate the region of interest
# by slicing the pixels of the image
roi = image[100 : 500, 200 : 700]
plt.imshow(roi),plt.title("REGION OF INTEREST IMAGE")

# Calculating the center of the image
center = (w // 2, h // 2)

# Generating a rotation matrix
matrix = cv2.getRotationMatrix2D(center, -45, 1.0)

# Performing the affine transformation
rotated = cv2.warpAffine(image, matrix, (w, h))
plt.imshow(rotated),plt.title("ROTATED IMAGE")
```

## OUTPUT-

Height = 1603, Width = 2400

ORIGINAL IMAGE



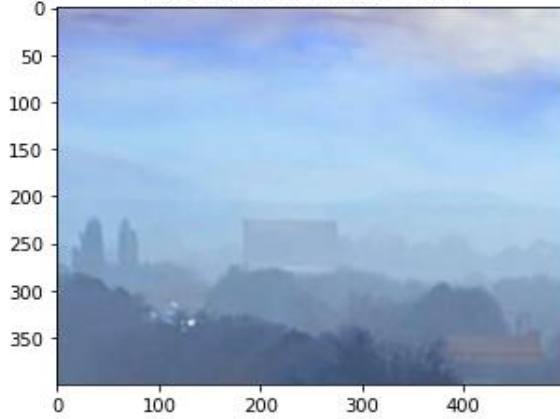
Height = 1603, Width = 2400

RESIZED IMAGE



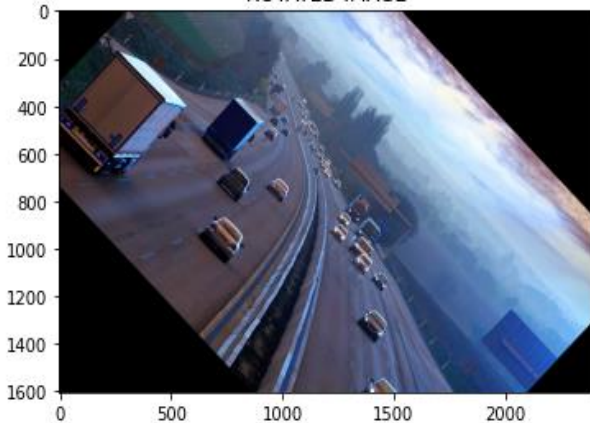
```
(<matplotlib.image.AxesImage at 0x7f397b7b9850>,  
Text(0.5, 1.0, 'REGION OF INTEREST IMAGE'))
```

REGION OF INTEREST IMAGE



```
(<matplotlib.image.AxesImage at 0x7f397b488dd0>,  
Text(0.5, 1.0, 'ROTATED IMAGE'))
```

ROTATED IMAGE



**RESULT-** The source code is executed successfully and the output was verified.

## PROGRAM NO-10

### ADVANCED IMAGE MANIPULATION USING OpenCV

**AIM-** Write a Python program

- a. To show the use of threshold() function to display variations in the image.
- b. To draw the rectangle in the image.
- c. To put text in the image.

#### **SOURCE CODE-**

```
# Importing the OpenCV library
import cv2
# Importing the matplotlib library
import matplotlib.pyplot as plt

# Reading the image using imread() function
image = cv2.imread('/road.jpg')
# Displaying the image using imshow() function
plt.imshow(image),plt.title("ORIGINAL IMAGE")

# Thresholding is cool
ret,thresh1 = cv2.threshold(image,127,255,cv2.THRESH_BINARY)
ret,thresh2 = cv2.threshold(image,127,255,cv2.THRESH_BINARY_INV)
ret,thresh3 = cv2.threshold(image,127,255,cv2.THRESH_TRUNC)
ret,thresh4 = cv2.threshold(image,127,255,cv2.THRESH_TOZERO)
ret,thresh5 = cv2.threshold(image,127,255,cv2.THRESH_TOZERO_INV)

titles = ['Original Image','BINARY','BINARY_INV','TRUNC','TOZERO','TOZERO_INV']
images = [image, thresh1, thresh2, thresh3, thresh4, thresh5]

for i in range(6):
    plt.subplot(2,3,i+1),plt.imshow(images[i],'gray')
    plt.title(titles[i])
    plt.xticks([],plt.yticks([]))

plt.show()

# Blurring - smoothes the image out
blur = cv2.blur(image,(10, 10))

plt.imshow(image), plt.title('Original')
plt.show()
plt.imshow(blur), plt.title('Blurred')
plt.show()

# We are copying the original image,
# as it is an in-place operation.
output = image.copy()
```

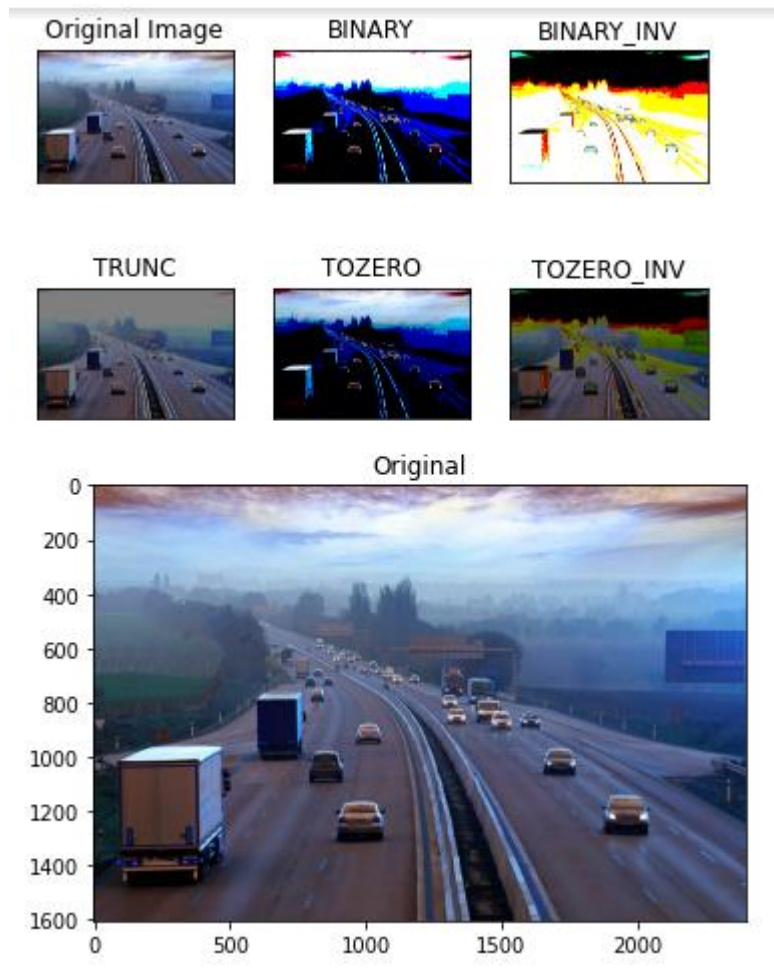
```

# Using the rectangle() function to create a rectangle.
rectangle = cv2.rectangle(output, (1500, 900),
                                (600, 400), (255, 0, 0), 3)
plt.imshow(rectangle), plt.title('Original with rectangle box')
plt.show()

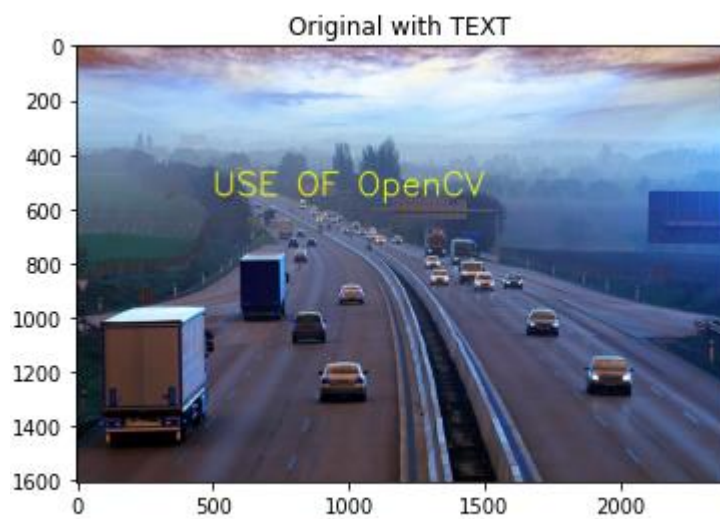
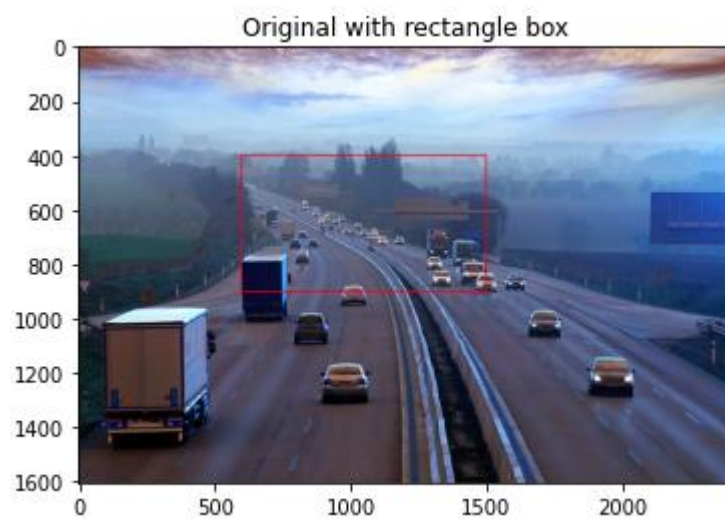
output = image.copy()
# Adding the text using putText() function
text = cv2.putText(output, 'USE OF OpenCV', (500, 550),
                   cv2.FONT_HERSHEY_SIMPLEX, 4, (255, 255, 0), 5)
plt.imshow(text), plt.title('Original with TEXT ')
plt.show()

```

## OUTPUT-







**RESULT-** The source code is executed successfully and the output was verified.

# ARTIFICIAL INTELLIGENCE (417)

## Sample Question Paper

Class X

Marks: 50

Time: 2 Hours

### SECTION A: OBJECTIVE TYPE QUESTIONS

SECTION A: OBJECTIVE TYPE QUESTIONS		
1	<p>Ramya and Ramu both own plant shops. Ramu sits at his shop every day. When customers come, he sells to them. Ramya walks around and gets customers to her shop. She also sells seeds and flowers. Who is Entrepreneur out of Ramya and Ramu.</p> <p>a) Ramya b) Ramu c) Both of the above d) None of the above</p>	1
2	<p>_____ refers to focusing human efforts for maintaining a healthy body and mind capable of better withstanding stressful situations</p> <p>a) Mental Health b) Emotional Health c) Self-Management d) Stress Management</p>	1
3	<p>Indian great Srinivasa Ramanujan had exceptional understanding of Theory of Numbers and Continuous Fractions and other Mathematical equations. He possessed _____ intelligence.</p> <p>a) Linguistic b) interpersonal c) Naturalistic d) logical- mathematical</p>	1

4	<p>_____ act as an interface between the user and the computer.</p> <ul style="list-style-type: none"> <li>a) Operating System</li> <li>b) Ms Excel</li> <li>c) Impress</li> <li>d) Digital Documentation</li> </ul>	1
5	<p>The Meta company's AI team recently trained an image recognition model to 85% accuracy using billions of public Instagram photos tagged with hashtags. The key technology behind this model is _____.</p> <ul style="list-style-type: none"> <li>a) NLP</li> <li>b) Computer Vision</li> <li>c) Data</li> <li>d) All of these</li> </ul>	1
6	<p>Which of the following is not an AI Domain?</p> <ul style="list-style-type: none"> <li>a) Deep learning</li> <li>b) Machine Learning</li> <li>c) Computer Vision</li> <li>d) Computer Aided Design</li> </ul>	1
7	<p>Choose the five stages of AI project cycle in correct order</p> <ul style="list-style-type: none"> <li>a) Evaluation -&gt; Problem Scoping -&gt; Data Exploration -&gt; Data Acquisition -&gt; Modelling</li> <li>b) Problem Scoping -&gt; Data Exploration -&gt; Data Acquisition -&gt; Evaluation -&gt; Modelling</li> <li>c) Data Acquisition -&gt; Problem Scoping -&gt; Data Exploration -&gt; Modelling -&gt; Evaluation</li> <li>d) Problem Scoping -&gt; Data Acquisition -&gt; Data Exploration -&gt; Modelling -&gt; Evaluation</li> </ul>	1



8	<p>_____ is the process of understanding the reliability of any AI model, based on outputs by feeding test dataset into the model and comparing with actual answers.</p> <p>a) Evaluation b) Problem Scoping c) Data acquisition d) Data Exploration</p>	1
9	<p>The people who face the stated problem and would be benefitted from the solution are termed as</p> <p>a) Stakeholders b) Key Persons c) Who d) End user</p>	1
10	<p>How many SDGs have been announced by the United nations?</p> <p>a) 20 b) 17 c) 30 d) 25</p>	1
11	<p>Which of the following statement is correct for problem scoping</p> <p>a) it will create real value for the organization b) it will create more confusion among the stakeholders c) it is a tool that prevents the problem will not recur d) it is a tool that provides a clear understanding of the data flow</p>	1
12	<p>You would feed the data into the machine. This is the data with which the machine can be trained. Now, once it is ready, it will predict his next data efficiently. This previous data is known as _____.</p> <p>a. Testing Data b. Training Data c. Exploring Data d. All of the above</p>	1
13	<p>The _____ block helps in analyzing the people getting affected directly or indirectly due to it.</p> <p>a. Who b. What c. Where d. Why</p>	1

14	<p>Name any 2 methods of collecting data.</p> <ul style="list-style-type: none"> <li>a) Surveys and Interviews</li> <li>b) Rumors and Myths</li> <li>c) AI models and applications</li> <li>d) Imagination and thoughts</li> </ul>	1
15	<p>You need to _____ which will become the base of your project as it will help you in understanding what the parameters that are related to problem scoping are.</p> <ul style="list-style-type: none"> <li>a. Acquire Data</li> <li>b. Database</li> <li>c. Data Mining</li> <li>d. None of the above</li> </ul>	1
16	<p>NLP stands for _____.</p> <ul style="list-style-type: none"> <li>a. Natural Language Processing</li> <li>b. Nature Language Processing</li> <li>c. None Language Processing</li> <li>d. None of the above</li> </ul>	1
17	<p>You called a company's customer care office. An application there responded you, spoke to you, asked broadly about your issue and then transferred your call to appropriate department. This is an example of _____ technology of AI.</p> <ul style="list-style-type: none"> <li>a) Machine Learning</li> <li>b) Big Data</li> <li>c) NLP</li> <li>d) Data Science</li> </ul>	1
18	<p>The driverless cars use _____ domains and technologies of AI.</p> <ul style="list-style-type: none"> <li>a) GPS</li> <li>b) Data</li> <li>c) Computer Vision</li> <li>d) all of these</li> </ul>	1

19	<p>_____ makes it possible to assign predefined categories to a document and organize it to help you find the information you need or simplify some activities.</p> <p>a. Automatic Summarization</p> <p>b. Sentiment Analysis</p> <p>c. Text Classification</p> <p>d. All of the above</p>	1
20	<p>_____ can be defined as the fraction of positive cases that are correctly identified.</p> <p>a. Recall</p> <p>b. Accuracy</p> <p>c. Precision</p> <p>d. Data acquisition</p>	1
<b>SECTION B</b>		
21	Name any 4 qualities of an entrepreneur.	2
22	List any 4 activities that help in stress management.	2
23	What are antivirus? Name any 2 antiviruses.	2
24	Explain the training data and testing data with an example	2
25	Speech recognition and response by machine is a revolutionary concept.	
26	What is 4Ws Problem Canvas?	2
27	What is a virtual assistant? Give Example?	2
28	What is Precision? Mention its formula.	2
29	Why is evaluation important? Explain.	2
Section C		
30	Explain how AI works in the following areas (any two):	4
31	What are the steps of text Normalization? Explain them in brief.	4
32	Write the applications of NLP (Natural Language Processing). (Any four)	4

