1. Communication Skills-II

🤖 Reboot (Page 33)

1. • Sender: The person ordering the pizza.
   • Message: The order details (pizza type, size, toppings, etc.).
   • Channel: Telephone.
   • Receiver: The pizza shop employee.
   • Feedback: The employee confirming the order.
   • Noise: Any disturbance like a bad phone connection.
   • Context: A food order conversation.
2. • Verbal Communication: Talking to a friend.
   • Non-Verbal Communication: Smiling at someone.
   • Written Communication: Sending an email.
   • Visual Communication: A road sign showing "Stop".
3. It is positive feedback (appreciation).
4. It helps share information with many people at once.

🤖 Reboot (Page 38)

1. • Direct Object: answers
   • Indirect Object: students
2. • Direct Object: a beautiful painting
   • Indirect Object: None
3. • Direct Object: pizza
   • Indirect Object: None
4. • Direct Object: a poem
   • Indirect Object: None
5. • Direct Object: a new dress
   • Indirect Object: his daughter

Exercise

🔒 Unsolved Questions

SECTION A (Objective Type Questions)

Quiz

A. 1. c   2. a & b   3. c   4. d   5. b   6. c & d

   7. b   8. a   9. c   10. a & b   11. a   12. d

B. 1. Communication   2. receiver   3. Non-verbal

   4. Communication skills   5. Decoding   6. Feedback

   7. communication   8. Constructive 9. General   10. linguistic

C. 1. False   2. True   3. False   4. True   5. False   6. True

   7. True   8. True   9. False   10. False

SECTION B (Subjective Type Questions)

A. 1. Verbal communication is the most popular form of communication where the transmission of messages occurs with the usage of words that can be in oral spoken or written form. It includes sounds, words, and speech. It is often used during presentations, video or teleconferences, informal or formal telephone calls, discussions, lectures, public speaking, meetings, etc.

   2. a. Think about your topic.

   b. Think about the most effective ways to make your listeners understand the topic.

   c. Write or note down whatever you plan to say.

   3. Feedback is a response of the receiver with respect to the message received from the sender. It works as an indicator for the successful transmission of the message thus making communication a two-way process.

   Examples:

   • "Nice work done by you."

   • "You were really good on stage but if you work more on your voice modulation, then you can do wonders."

   4. Positive feedback focuses on the sender's strengths, achievements or successes. It also takes care of the areas of improvement and creates a positive attitude for the sender.

   For example:

   • "Nice work done by you."

   • "You were really good on stage but if you work more on your voice modulation, then you can do wonders."

Negative feedback highlights the weaknesses and problems of the information that the sender has conveyed to the receiver. It should be genuine or true to bring a positive change in the process of communication.

For example:

- "You did not submit your assignment."
- "You wrote your answers very badly."
- Taking long time to reply email, SMS.
- Not smiling at the time of meeting.

5. Culture is values and principles followed in the lives of people living in society. It is the sharing of customs, rituals, beliefs, ideas, art, knowledge, values, morals, ideals, etc. amongst people living in their own geographically restricted areas.

6. When the subject in the sentence has performed or received the action it becomes the voice of a verb in the sentence. In an active sentence the action is performed by the subject. It is a strong and direct way of expressing a sentence.

For example: Shweta is eating chocolate.

7. Article is a word that describes the noun. It is used before a noun to show whether it is specific or not. In English grammar there are three articles—A, An, The.

8. Direct Objects: Direct objects come after a verb and are directly 'acted on' by the verb. It answers the question "what?" or "who?".

For example: She sang on Annual day. Peter doesn't like Maths.

Indirect Objects: Indirect object is the recipient of the direct object. It answers the question "to whom?", "for whom?".

For example: She made a cake for her mother's birthday. He wrote a letter to his friend.

9. Collection of relevant and meaningful words following the rules of a language will form a sentence. Every word you use in a sentence has its own role to play. Every word has a specific function to play in a sentence to make it meaningful. It falls into different categories to play a different role in a sentence. These categories are called the Parts of Speech. It is important to learn these different parts of speech to understand the language well to help you construct good sentences for effective communication.

10. Noun is a word to name a person, place, thing or an idea.

For example: Goa is a beautiful place. My pen is broken.

Pronoun is a word that replaces a noun. They are used to avoid the repetition of nouns so that the sentences are smoother and effective.

For example: Words are: I, she, her, you, himself, some, we, you, each, who, which, that, mine, yours, his, her

B. 1. **Sender:** Sender is a person or entity who starts the communication process. He will convey a message with the purpose of passing meaningful information/ideas to others involved in the communication cycle.

Message: It is the information which the sender wishes to convey to the receiver. It is the subject with the actual content of the whole process of communication.

2. **Cultural Barrier**

Culture is values and principles followed in the lives of people living in society. It is the sharing of customs, rituals, beliefs, ideas, art, knowledge, values, morals, ideals, etc. amongst people living in their own geographically restricted areas.

- As the mindset of people of different cultures are different, so is their language, signs and symbols. This causes a barrier to communication.
- Culture also gives rise to prejudices and stereotypes. These become the societal norms, thus becoming a barrier to effective communication amongst people of different cultures.
- Different cultures adopt different ways of communication. For example, some cultures may be very open while others may be orthodox, thus affecting ways people communicate among various cultural sects. For example, in Arab countries it is considered to be a social crime to greet an opposite gender by shaking hands.

Linguistic Barrier

The inability to communicate using a language is known as a language barrier to communication. This inability may be due to lack of common language, inefficiency to use the language since it is not a mother tongue or speaking disability.

- An English person traveling to Japan will not be able to interact with Japanese people if he doesn't know Japanese.
- Sometimes, people belonging to different places may be speaking the same language but have different pronunciation, dialect, meaning and interpretation which may lead to miscommunication, thus altering the overall process of communication.
- Sometimes, a specific organisation or industry uses certain technical words or symbolic words or jargons and slangs which make it easy to communicate. If a new employee joins or is transferred to a new environment, then the efficiency of the whole process may reduce due to lack of knowledge of these words.
- Some people may have language disabilities such as stuttering, dysphonia or hearing loss while others working with these people in an organisation may be spontaneous and grasp things easily which creates a lot of difficulty in communication.

3. **Clear**

The message intended to be delivered through communication should be clear and in understandable format. Clarity in writing or speaking of the message plays a very important role in effective communication.

Concise

The message must be conveyed by using only limited words. Avoid using fancy, unwanted or repetitive words or fillers otherwise the actual message intended to be conveyed may get lost in the long content.

Concrete

The content of the message should use only necessary words with complete facts and figures to avoid misinterpretation of the message by the receiver.

4. The process of giving a feedback should follow the given steps:
   1. The message should be clear, and interpreted properly by the receiver.
   2. If the message is not clear, then clarify from the sender by asking questions.
   3. Always refers to the original form of message to understand it clearly.
   4. Convey the response in the form of feedback to the sender.

5. Inadequate flow of information amongst employees working at different levels of hierarchy may lead to organisational barriers.

   This may be due to:
   - The restricted rules and policies of an organisation as the employees avoid getting into the hassle of sending or receiving any message. For example, if the company rule says that all communication should be in writing, then even a small message where time constraint plays a very important role in decision making may lead to delay in the transmission due to writing formalities and level of approval required from different people.
   - A formal communication protocol is always followed when communication takes place between a senior and his subordinate. In such situations, a subordinate employee will always have fear, anxiety and withdrawal in communication.

6. **Eye Contact**

   Keeping a proper eye contact shows you are mentally present and actively involved in communication. The way you look at someone will reflect some of the strongest emotions and feelings during a social conversation. Rolling your eyes expresses displeasure or unhappiness with a situation.

   Eye contact helps you:
   - Facilitate the connection with your audience in a meeting, conference, presentation, etc.
   - Improve your concentration
   - Give confidence and authority
   - Retain the important points of conversation
   - Express your emotions like sadness, happiness, surprise, fear, etc.

Body Posture

Body posture is the position of the human body and its alignment and orientation with respect to non-verbal communication. During a conversation, the way you sit or stand and communicate your body postures to others depends a lot on your attitude and emotional state. Before you start a conversation, standing straight and holding your head high will have a great impact on the crowd.

The correct body postures for effective non-verbal communication are:

• Keep your shoulders straight and body relaxed

• Sit straight while resting your hands and feet in a relaxed position

• While standing, keep your hands by your sides

Appearance

Appearance includes our choice of colour, body cleanliness, properly dressed, hairstyles, etc. When you are speaking in public, you may be representing your organisation or just yourself. You should ensure that you are properly and neatly dressed. It also increases your self-confidence and you will definitely feel good about yourself.

7. Visual Communication is the transmission and interpretation of information by using visual resources like photographs, videos, art, drawings, sketches, charts and graphs. Visuals enhance the process of communication during written or verbal communication for better understanding and a meaningful interpretation of the information. It has a great impact on our day-to-day life.

For example, traffic signals for stop, wait or go. To indicate 'danger' we use a red colour sign, to indicate 'no smoking' we use an image showing a lighted cigarette with a cross mark on it, etc.

Some of the common examples of visual communication in our day-to-day lives are:

Horn Prohibited

No Parking

Ladies and Gents Toilet

No Left Turn

Red light indicates Stop, Yellow light indicates Wait and Green light indicates Go

8. a. **Encoding and Decoding a message**

   Encoding: It is the process of converting the message into a form in which only the intended receiver can understand by converting the actual message into symbols, words, actions, and diagrams.

   Decoding: It is the interpretation of the message delivered by the sender.

   b. **Verbal and Non-Verbal Communication**

   Verbal communication is the most popular form of communication where the transmission of messages occurs with the usage of words that can be in oral spoken or written form. It includes sounds, words, and speech. It is often used during presentations, video or teleconferences, informal or formal telephone calls, discussions, lectures, public speaking, meetings, etc.

   Verbal Communication can be divided further as:

   • Oral or Spoken Communication: Communication which involves speaking. It can be face-to-face conversation or talking on a phone.

   • Written Communication: Communication which involves written or typed words. It can be writing letters, notes, email, etc.

   Non-verbal communication is defined as communication through physical and physiological cues without using spoken or written words. The information is transmitted using body language, touch, facial expressions, symbols, signals, etc. Most of our communication with the people around us throughout the day is non-verbal and most of the time we are not aware of it. It is helpful when trying to understand others' thoughts and feelings.

   Non-Verbal communication can be further classified into: Facial Expressions, Body Language and Gestures, Eye Contact, Body Posture, Appearance, Personal Space and Proximity, Paralanguage, and Haptics.

9. a. **Verbal communication**

   Advantages

   • The information conveyed can be saved for future use by recording the verbal or written communication.

   • The exchange of ideas and thoughts are straightforward, quick and saves a lot of time.

   Disadvantages

   • Lengthy messages (written or oral) are difficult to comprehend, unsuitable, and boring especially in a crowd.

   • As messages are delivered instantly, there is no scope for rectification of wrong words used in oral or written messages.

b. **Non-Verbal communication**

Advantages

- It is used as complimentary with verbal communication to enhance the effect of communication.
- It is a useful, fast and easy method of communication where no common language is required to master.

Disadvantages

- Since it uses gestures, facial expressions, eye contact, touch, signs, sound, etc. for communication, there are chances of misinterpretation of the message required to be delivered.
- It is not suitable for long and lengthy messages as the actual message may get lost in a lengthy and time consuming conversation.

c. **Visual communication**

Advantages

- When the content is lengthy and difficult to explain, then it can be easily handled through visuals in a shorter period of time.
- There is no prerequisite of learning a specific language and can be used by people in different geographical areas with different cultures.

Disadvantages

- It is a time-consuming process as designing and decorating takes more time than writing or conveying orally.
- Visuals alone are not a complete way of delivering meaningful information. It needs other forms like verbal and non-verbal to complete its communication.

10. A sentence is made up of:
    - Subject: A subject is a noun that refers to a person, place or thing.
    - Verb: It is the action done by the subject.
    - Object: It is a person, place or thing that receives an action and gets affected.

    For example:

    He drove a brand new car.

    Subject: He   Verb: drove   Object: new car

    My mother cooks wonderful food.

    Subject: My mother   Verb: cooks   Object: wonderful food I love ice cream.

    Subject: I   Verb: love   Object: ice cream

11. A paragraph is a collection of relevant sentences with a common theme. It begins with an introduction of a theme, followed by sentences describing a theme and ends with a statement supporting a common idea.

For example: Water is an essential component of our life. With its scarcity all across the world it is becoming a threat to the existence of life on earth. With rising levels of pollution, water resources are being depleted rapidly. The entire Earth consists of 71% water, out of which only a small percentage is drinkable freshwater. It is therefore very essential to save water, to save lives.

Some general rules for writing a paragraph are:

- It begins on a new line.
- The first line has an indentation.
- It focuses on a main theme.

C. Competency-based/Application-based questions.

1. **Physical Barrier:** Physical barriers arise due to environmental or geographical factors that hinder effective communication. Some possible reasons for Rakesh's communication challenges include:

   - **Noise disturbances:** Traffic sounds, classroom noise, or background music might prevent him from clearly hearing instructions.
   - **Uncomfortable environment:** Extreme temperatures in the classroom may cause discomfort and reduce concentration.
   - **Technical issues:** If digital tools are used in the class, poor internet connectivity or malfunctioning devices may affect understanding.
   - **Classroom infrastructure:** Poor seating arrangements, inadequate lighting, or faulty audio systems can create distractions and hinder communication.

   These physical barriers may prevent Rakesh from fully grasping what is being communicated, leading to difficulties in following instructions.

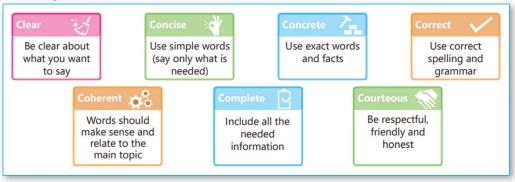2. Effective communication methods for Rahul:

   - Use positive reinforcement: Encourage his brother by appreciating his efforts before pointing out mistakes.
   - Be patient and clear: Explain corrections in a simple and understandable way.
   - Use active listening: Ask his brother for feedback to ensure he understands and values the guidance.
   - Choose the right tone: Speak in a friendly and supportive manner rather than sounding critical.

- Provide examples: Show correct answers through real-life examples or relatable explanations.

3. • Be relaxed, calm and confident when you walk-in for starting a communication.

   • Keep smiling in between as it shows that the person is confident and trustworthy.

   • Stand or sit with a relaxed posture and straight spine.

   • Keep your arms open and by your side when not communicating.

   • Do hand shake, bow or namaste before you begin with the conversation.

   • Make eye contact occasionally to show your level of involvement.

   • Be a good listener and nod in between while listening.

   • A little movement is necessary if you are giving a presentation.

   • Place your feet firmly on the ground while moving during your presentation or addressing a gathering.

   • Give a positive facial expression and try to be natural with your gestures.

▶ **Video Session** (Page 52)

1. Verbal Communication is the most popular form of communication where the transmission of messages occurs with the usage of words that can be in oral or in written form.

2. Following are the 7Cs of communication:

Clear	Concise	Concrete	Correct
Be clear about what you want to say	Use simple words (say only what is needed)	Use exact words and facts	Use correct spelling and grammar

Coherent	Complete	Courteous
Words should make sense and relate to the main topic	Include all the needed information	Be respectful, friendly and honest

Lab Activity (Page 52)

Do it yourself.

Class Activity (Page 53)

Do it yourself.

2. Self-Management Skills-II

Reboot (Page 57)

1. • Lack of sleep
   • Loss of appetite
   • Restlessness and anxiety
   • Loss of interest and focus
   • Frequent headaches
   • Memory loss
   • Frequent mood swings
   • Social withdrawal or isolation

2. Stress can be defined as our emotional, mental, physical and social reaction, to any perceived demands, or threats.

3. Whether you are facing good stress or bad stress, it is important to learn some stress management techniques to minimize the negative impact on mind and body.

Reboot (Page 59)

1. a. Time Management
   b. Physical Exercise and Fresh Air

2. The practice of yoga involves stretching the body and forming different poses while keeping your breathing slow, and controlled. This will relax the body and energise it at the same time.

Reboot (Page 60)

1. A good sleep helps you manage the stress of a tough day. It rejuvenates the mind and body, improves your concentration power, regulates your mood swings and sharpens your brain for better decision-making power. Sleep is so important that irregular sleeping patterns or slight sleep deprivation can bring irritation in your behaviour, and cause severe mood swings.

2. Meditation is an age-old practice that produces a deep state of relaxation and helps you focus on one thought and clear the others. It works to reverse the effects of stress by providing rejuvenation and repair of the mind and body. Thus, preventing further damage from the physical effects of stress.

3. Advantages:
   • Increased Focus
   • Making Progress on Assignments
   • Working at Your Own Pace
   • Can Work Remotely
   • Better Job Satisfaction

Reboot (Page 62)

1. My top four strengths are hard work, creativity, problem-solving, and teamwork.

2. I use my interest in learning and my abilities to stay focused, complete assignments on time, participate in class activities, and help my friends understand difficult topics.

3. Creativity helped me recently in my project, as I used innovative ideas to present my work, making it more engaging and well-organized, which helped me get good grades.

Exercise

🔒 Unsolved Questions

SECTION A (Objective Type Questions)

Quiz

A. 1. c   2. b   3. d   4. c   5. b

B. 1. Stress   2. eustress   3. financial stress   4. Exercises

     5. negative   6. values, priorities   7. Confidence, self-discipline, determination

     8. Time management skills

C. 1. True   2. True   3. False   4. True   5. True   6. True

     7. False   8. True   9. False   10. True

SECTION B (Subjective Type Questions)

A. 1. Goal setting is the process of identifying your dreams and then planning and implementing your methods, and strategies to fulfil them. Goal settings provide you with a target and help you focus on what's really important to you, which will make you successful in your career and personal life.

2. Stress Management is a method or a technique used to make changes in your lifestyle, thoughts, and emotions that help you relax your mind, and body to minimize the effects of stress.

3. The practice of yoga involves stretching the body and forming different poses while keeping your breathing slow, and controlled. This will relax the body and energise it at the same time.

4. **Symptoms:**
   - Lack of sleep
   - Restlessness and anxiety
   - Frequent headaches
   - Frequent mood swings
   - Loss of appetite

5. **Advantages:**
   - Manage your energy levels.
   - Understand your emotions and behaviour.
   - Balance your thoughts and emotions.
   - Understand your long term goals.
   - React in a positive way in difficult circumstances.
   - To be happier by controlling your emotions.

B.
1. Good stress, also known as "Eustress", occurs when we are excited. Our heart beat faster, and we feel a rush of hormones in our body, but it is not dangerous for us. We also feel this good stress before a public performance, ride in water parks, or when the exam result is declared. This kind of stress keeps us lively and excited in life. So in the short term, stress can have a positive impact on us, and our behaviour. Eustress motivates us to achieve more, but when the duration of stress increases for a long time then, it takes the shape of bad stress, which may cause physical or mental health problems. Exam stress, for instance, is beneficial to you since it helps you stay alert and study for the test; however, chronic stress can lead to health problems such as headaches, nausea, and fainting during the test. Thus, stress management is crucial to success in life.

2. Time Management When you feel that there is too much to do and not enough time then, you start getting panic attacks, lose focus and make errors in your work. Good Time Management techniques will help you prioritise your task and manage your commitments. Make a list of the work in terms of urgent, important, and not important. This will put you in control of your situation and help you increase your productivity. In academic life, keeping your notes organised, finishing assignments on time, and tracking deadlines can help reduce stress.

3.

Interests	Abilities
Things that you like to do in your free time that make you happy.	An acquired, or natural capacity.
Things you are curious about, or would do even if no one asked you to do it.	Enable you to perform a particular job or task with considerable proficiency.
Things you want to learn or would like to do in the future.	Skills that you have developed, or are developing, that make you proficient in certain tasks.
Example: Curiosity to learn a musical instrument, desire to travel, and explore new cultures.	Example: Mastery in playing the guitar, ability to navigate and adapt to different cultural environments.

4. Time Management is the ability to utilise your time effectively so that you are able to do the required task at an appropriate time. It helps you focus better on important tasks, which leads to better efficiency. It gives you a feel that you are never running out of time.

- Plan your activities to avoid any delay or postponement of assigned tasks.
- Organise your work. Keep your desk clean. Put everything in place at home, and in school. Put the books back on the shelves.
- Find a place with minimum disturbance so that you are able to complete your assigned tasks.
- Make a reasonable 'To-do' list.
- Prioritise your task based on its importance.
- Spend your time efficiently.
- Look for activities that save you from wasting time on insignificant activities.

5. Keeping track of your daily time helps you stay focused and avoid wasting time on unnecessary activities. By noting how you spend each hour, you can see which tasks are important and which ones take up time without adding value. This habit allows you to manage your time better, stay productive, and work towards your short-term and long-term goals. At the end of the day, you can review your progress and make improvements.

C. Competency-based/Application-based questions.

1. Neha should highlight skills such as goal setting, time management, positive thinking, self-discipline, and resilience. Encouraging students to stay focused, break tasks into smaller steps, and reward themselves for progress can help them stay self-motivated and take charge of their learning.

2. It is important to judge yourself based on your own views and performance rather than others' expectations. Setting personal goals and evaluating progress based on your own efforts helps build confidence and self-worth.

3. To help Sohan manage exam stress, I would suggest techniques like deep breathing exercises, regular breaks while studying, maintaining a balanced diet, getting enough sleep, and practicing positive affirmations. Encouraging him to stay organized and revise with a clear plan can also reduce anxiety.

▶ **Video Session** (Page 71)

Do it yourself.

Lab Activity (Page 71)

Do it yourself.

Class Activity (Page 71)

Do it yourself.

3. Information & Communication Technology Skills-II

🤖 **Reboot** (Page 83)

1. The Notification Area is a small part of the taskbar in Windows that shows system icons, time, battery, volume, and app notifications.
2. Windows 11 has several components, including the Start Menu, Taskbar, File Explorer, Notification Area, and Settings.
3. Data is stored in the form of files and folders on a computer, which can be documents, images, videos, or software programs.

Exercise

🔒 **Unsolved Questions**

SECTION A (Objective Type Questions)

Quiz

A. 1. a   2. b   3. b   4. c   5. d   6. a

B. 1. file   2. name, extension   3. Shortcut   4. folder   5. Virus

    6. Computer maintenance   7. Backup   8. Disk cleanup

C. 1. True   2. False   3. False   4. True   5. True   6. True

SECTION B (Subjective Type Questions)

A. 1. Mobile operating systems have Graphical User Interface with menus and buttons supporting different types of apps on Smartphones, tablets, smart watches or other portable devices. It is a combination of an operating system and communication technology.

2. File: Any data in the computer is stored in the form of a file.

   Folder: Folder is a collection of related files and subfolders.

3. Utility software does housekeeping functions like backing up disk or scanning/cleaning viruses or arranging information etc. They ensure the smooth functioning of the computer.

4. Steps to Delete Temporary Files on Your Computer:

   1. Press Windows + R to open the Run dialog box.
   2. Type %temp% and press Enter.
   3. A folder with temporary files will open.
   4. Press Ctrl + A to select all files.

5. Press Delete on your keyboard and confirm.

6. Empty the Recycle Bin to remove them completely.

5. **Use a soft cloth** – Wipe dust from the monitor, keyboard, and CPU.

Use compressed air – Clean inside the CPU and keyboard to remove dirt.

Keep devices in a dry place – Avoid moisture to prevent damage.

6. Data backup is important because it protects important files from being lost due to system crashes, viruses, or accidental deletion. It helps in recovering data when needed.

B. 1. Computer virus is a malicious code that attaches itself to a file and enters your computer system and makes copies of itself and carries out the harmful tasks in such a way that it damages the important files of an operating system or application programs or important data files due to which the computer may stop working.

Major types of viruses are Worms and Trojan Horse.

- Worms: Computer worms are a type of malicious software or malware that can replicate and spread on their own mainly across computer networks.

- Trojan Horse: This malicious software disguises itself as a useful software but is designed to carry out harmful activities on a computer. The name "Trojan Horse" comes from the ancient Greek story of the wooden horse used to infiltrate the city of Troy.

2. • Avoid clicking on unknown clicks available in between your internet browsing.

- Do not reply to spam messages.

- Download spam filtering tools and anti-virus software.

- Do not use your personal or business email address when registering in any online contest or free services available on the internet.

3. Security break refers to the unauthorised access of sensitive information stored in a computer.

Personal information can be lost or leaked in two ways:

- We are not careful in giving out personal information over the Internet. For example, we share our account details and passwords on unsecure sites.

- A person gets unauthorized access to our computer. This can happen in the office if we leave the computer without logging out.

C. **Competency-based/Application-based questions.**

1. Neha should follow these steps to remove the virus:

- Run a full system scan using a trusted antivirus software.

- Delete or quarantine the infected files as suggested by the antivirus.

- Update the antivirus and operating system to prevent future attacks.

- Avoid downloading files from unknown sources.

2. Niharika pressed too hard, which may have damaged the screen. She should have:

- Used a soft microfiber cloth to gently wipe the screen.
- Avoid using too much pressure or rough materials.
- Used a screen-safe cleaning solution instead of spraying liquid directly on the screen.

Lab Activity (Page 99)

Do it yourself.

Class Activity (Page 100)

Do it yourself.

4. Entrepreneurial Skills-II

Find on Google (Page 106)

Kaivalya Vohra

Reboot (Page 110)

The misconceptions are:

1. Kavita thought only unique ideas succeed, but many businesses grow with simple yet well-executed concepts.
2. Aman believed large funding was necessary, but many entrepreneurs start small and grow gradually.
3. Meera assumed entrepreneurship is only for big companies, but even small online stores are part of entrepreneurship.

Exercise

🔒 Unsolved Questions

SECTION A (Objective Type Questions)

Quiz

A. 1. b   2. d   3. c   4. d   5. d

B. 1. opportunity recognition, idea development, business startup

    2. Change'   3. career   4. Entrepreneurship   5. Innovation

C. 1. True   2. True   3. False   4. False   5. False

SECTION B (Subjective Type Questions)

A. 1. A perseverant person does not give up easily and keeps trying even when things are difficult.

2. Anyone with a good idea, willingness to take risks, and the ability to work hard can become an entrepreneur.

3. • Creates jobs for people
   • Helps the economy grow
   • Brings new and useful products or services

4. • You need a lot of money to start a business
   • You must have a unique idea to succeed
   • Entrepreneurs don't fail

5. A misconception is a wrong belief, while reality is the truth.

   Example: Misconception – "Entrepreneurs don't take risks." Reality – "Entrepreneurs take smart risks to succeed."

B. 1. Entrepreneurs manage their business operations, making strategic decisions to drive growth and profitability. They also innovate, adapt to market changes, and solve problems to meet customer needs and demands.

   Some of the actions of entrepreneurs are listed below:

   • Fulfil Customer Needs: Demand means a product or service that people want. Entrepreneurs find out what people want. Then, they use their creativity to come up with a business idea that will fulfil the changing demands of the customers.

   • Use Local Materials: Entrepreneurs utilise available materials and people around them in innovative ways, combined with new technology, to create new products at a reasonable cost.

   • Help Society: Entrepreneurs foster a beneficial relationship with society by generating profits through activities that enhance societal well-being. Some entrepreneurs focus on environmental conservation, while others contribute funds for building schools and hospitals, thereby improving the communities in which they live.

   • Develop the Country: With the success of an entrepreneur the people connected to it all share the success and thus helps in the overall development of the country.

2. In order to become successful, an entrepreneur needs to perform different roles. The following are the roles of an entrepreneur:

   • Innovator's Role: An entrepreneurship is about new and creative ideas converted into a real world of business which is beneficial both for the entrepreneur in making profits and for the customer in getting a new product in the market. All those once was just an idea but only entrepreneurs brought those ideas to life.

- **Agent's Role:** Entrepreneurs are considered as 'Agents of Change'. They look for opportunities that help in converting their dream or passion into reality by initiating and creating a business and converting all the challenges faced into a new successful product. This product creates a new market and helps in raising the standards of the community and contribute to the overall development of the economy.

- **Risk Assumption Role:** An entrepreneur assumes all possible risks of business rising from unstable market conditions, change in the customers preferences, new emerging technologies in the production, change in environmental factors, and fluctuations in the profits.

- **Capital Formation Role:** Setting up an enterprise needs investment. This investment can be taken from personal savings, loans, shares etc. The money is utilised in the capital formation like developing infrastructure in the nearby area, developing the network and transport facilities. All these efforts help in the company trade and capital formation of the country.

- **Employment Generation Role:** Entrepreneurs generate employment for both skilled and unskilled labourers by setting up large and small-scale businesses. This leads to the reduction in unemployment levels in the country.

3. Entrepreneurship offers several advantages that attract individuals to start and grow their own businesses:

- **Flexibility and Independence:** Entrepreneurs have the freedom to set their own schedules, make decisions autonomously, and pursue creative ideas without the constraints of traditional employment.

- **High Rewards:** Successful entrepreneurs have the potential to earn substantial profits and build wealth through their ventures. They can also benefit from the scalability of their business ideas.

- **Job Creation:** Entrepreneurship stimulates job creation and economic growth by hiring employees, subcontractors, and suppliers, thereby contributing to the community and economy.

- **Personal Growth:** Entrepreneurship provides opportunities for personal development and learning. Entrepreneurs continually face challenges that help them develop resilience, critical thinking skills, and leadership qualities.

Entrepreneurship, while rewarding, also comes with its own set of challenges and disadvantages:

- **Financial Uncertainty:** They often face financial instability, especially in the initial stages of their venture. Cash flow problems, difficulty securing funding, and the risk of personal financial loss can be significant stressors.

- **Long Working Hours:** Entrepreneurs typically work long hours, including evenings and weekends, to build and sustain their businesses. This can lead to burnout and strain personal relationships.

- Risk of Failure: The failure rate for startups and new businesses is high. Many ventures fail due to market changes, competition, or unforeseen challenges.

- Increased Responsibility: Entrepreneurs often bear ultimate responsibility for the success or failure of their ventures. This includes managing employees, satisfying customers, managing legal and regulatory issues, and more.

4. a. Optimistic: Entrepreneurs take risks in terms of time and money. They put their dreams into action so they need to be optimistic to see the success of their dreams. Optimistic people tend to be more creative in their thinking. It stimulates all kinds of creative ideas which will lead to new products, services, or businesses having a greater chance of success. Sometimes, they even face so many problems and setbacks but still won't give up.

   b. Independent: An entrepreneur is someone who establishes new ventures through their own innovative ideas. They thrive on working independently, making critical decisions for their venture. They take full responsibility for the outcomes of their independent decisions. Freedom to work and take ownership is often cited as a key advantage in successfully running their own business.

5. A career is a line of work that a person takes for life. A person who becomes an entrepreneur goes through a career process.

   This process is as follows:

   - Enter: It means implementing an idea by starting a business and entering a new market. For example, Amit is starting a small stationery store in his locality.

   - Survive: It means to remain in the competitive market in between other entrepreneurs dealing with the same business. For example, there are many other stationery stores in the area. Despite this, Amit is surviving the competition and doing well. He even bought the next-door shop and expanded his small store to a big fancy stationery outlet.

   - Grow: It means after attaining a reputation and stability, an entrepreneur plans to expand the existing business. For example, after a few years, Amit has opened a chain of three more stationery stores in the same city. He even plans to expand it to other neighboring cities as a new brand.

C. **Competency-based/Application-based questions.**

1. To be a successful entrepreneur, I should have qualities like creativity, problem-solving skills, leadership, risk-taking ability, and determination. My action plan includes identifying a business idea, researching the market, making a budget, and planning marketing strategies. The name of my company will be "InnoTech Solutions," with a modern and innovative logo. The slogan will be "Innovate, Elevate, Succeed!"

2. One inspiring success story is of Elon Musk, the founder of Tesla and SpaceX. He started with PayPal and later launched innovative companies that changed the automobile and space

industries. His vision and risk-taking ability made him a global entrepreneur. I will collect pictures, facts, and figures about his achievements and create a project on his journey.

3. I will explain to my cousin that taking calculated risks is essential for success. Many famous entrepreneurs like Steve Jobs and Jeff Bezos took risks to build their businesses. I will encourage him to start small, plan wisely, and not fear failure because failures teach valuable lessons. If he is passionate and hardworking, he can turn his dream into reality.

4. I will advise Vedika to start her business as a side project while working a job for financial stability. She can save money and explore funding options like investors, business loans, or crowdfunding. If her start-up starts growing, she can leave the job and focus full-time. This way, she won't take a huge risk but can still follow her dreams.

▶ **Video Session** (Page 115)

Do it yourself.

Lab Activity (Page 115)

Do it yourself.

Class Activity (Page 116)

Do it yourself.

5. Green Skills-II

Reboot (Page 124)

1. Goal 4 aims to ensure inclusive and quality education for all and promote lifelong learning opportunities.

2. There are several major problems, including climate change, pollution, poverty, deforestation, and resource depletion.

3. **Climate change** – Rising global temperatures and extreme weather affect ecosystems and human life.

   Resource depletion – Overuse of natural resources leads to scarcity and environmental degradation.

4. Sustainable development ensures a balance between economic growth, environmental protection, and social well-being, securing a better future for the next generations.

Exercise

🔒 Unsolved Questions

SECTION A (Objective Type Questions)

Quiz

A. 1. a   2. d   3. d   4. c   5. d

B. 1. Sustainable development   2. Solar energy

    3. NITI Aayog   4. 6 (Clean Water and Sanitation)

    5. Organic

C. 1. c   2. e   3. d   4. b   5. a

D. 1. True   2. True   3. False   4. False   5. True

SECTION B (Subjective Type Questions)

A. 1. (i) No Poverty   (ii) Zero Hunger

    (iii) Quality Education   (iv) Climate Action

    (v) Clean Water and Sanitation

   2. (i) Lack of funding and financial resources

    (ii) Climate change and environmental degradation

   3. (i) Protects natural resources for future generations

    (ii) Improves economic growth and stability

    (iii) Reduces pollution and environmental damage

   4. The aim is to eradicate poverty, ensure environmental sustainability, promote economic growth, and improve the overall well-being of people worldwide by 2030.

   5. It teaches us to use resources efficiently, avoid wastage, and ensure they are preserved for future generations.

B. 1. The specialised skills which are important for building or developing a Sustainable Green Economy are called Green Skills. Learning green skills is one of the major ways to enhance knowledge, abilities, values, and attitudes to develop and support organisations that focus on improving environmental conditions. The Government of India launched the Green Skills Development Programme (GSDP) in India in the year 2017, started by the Ministry of Environment, Forest and Climate Change MoEFCC in partnership with the National Skill Development Agency (NSDA). It aims to develop green skilled workers having technical knowledge and commitment to sustainable development. The program supports the attainment of Nationally Determined Contributions (NDCs), Sustainable Development Goals (SDGs), National Biodiversity Targets (NBTs) and Waste Management Rules 2016.

2. There are three major problems related to sustainable development. Let us discuss them one-by-one.

   Food

   As we are using up more and more land for designing concrete jungles, we are reducing the land for cultivation of crops. Soil nutrients are also depleting due to pollution from industries, overgrazing of land etc. Overpopulation is another threat for the shortage of food all across the world.

   Water

   The supply of fresh drinking water from rivers and ponds is limited worldwide. Due to pollution, these water bodies are contaminated, leaving very little water available for actual use.

   Fuel

   Forests are cut down for fuel leaving barren land where soil erosion will lead to soil degradation and a drastic change in climatic conditions. An increase in the consumption of oil and natural gas has led to an increase in the level of carbon dioxide causing a change in the climatic conditions. We are using a lot of wood from trees for the construction of homes and furniture. Extreme weather conditions, such as floods, extreme cold, or heat, are seen in many places, which affect the people living there.

3. **Goal 14—Life below Water:** This goal focuses on protecting life underwater by eliminating pollution, overfishing, and illegal fishing practices to achieve healthy and productive oceans. Oceans, seas, and rivers are home to more than 2 million estimated species. These underwater species provide life support and regulate our climatic conditions. We all need to conserve and consciously use the world's oceans, seas, and marine resources to make them sustainable for present and future generations. For example, Integrated Coastal Zone Management (ICZM) Project aims to conserve and manage coastal and marine ecosystems, biodiversity, and resources sustainably, supporting the livelihoods of coastal communities while protecting marine habitats.

   Goal 15—Life on Land: This goal ensures stopping further damage to life on earth by deforestation, loss of natural habitats, and land degradation so that all nations together can work to conserve and sustainably use biodiversity and ecosystems. By stopping the cutting of trees and forests, land degradation, fragmentation and overgrazing will help in preserving and restoring terrestrial ecosystems such as forests, wetlands, grasslands, drylands and mountains. Cutting trees is leading to soil erosion and making land dry and unusable for cultivation. For example, National Afforestation Programme (NAP): Aims to increase forest and tree cover to enhance biodiversity, combat desertification, and mitigate climate change impacts in India.

4. a. Many countries and companies are still giving priority to their own profits, at the cost of overuse and exploitation of natural resources.

b. Many countries want to show their power and prove themselves best by using their nuclear weapons and encouraging the destruction of nature and mankind. In such conditions, ensuring world peace is a global challenge.

c. Many countries are still not serious about taking the initiatives and implementing the policies in favour of SDGs. Due to this lack of interest, there is a huge world population which is still insensitive towards its needs.

5. Three Sustainable Development Goals (SDGs) Relevant to My Country

   1. **Quality Education (SDG 4)**
      - Provide free and accessible education to all children, especially in rural areas.
      - Improve teacher training and digital learning facilities.
      - Implement skill-based education to enhance employability.

   2. **Clean Water and Sanitation (SDG 6)**
      - Ensure safe drinking water supply in both urban and rural areas.
      - Implement strict regulations to prevent water pollution.
      - Promote water conservation through rainwater harvesting and wastewater treatment.

   3. **Decent Work and Economic Growth (SDG 8)**
      - Support startups and small businesses with financial aid and mentorship.
      - Encourage sustainable industries that generate employment.
      - Ensure fair wages and better working conditions for all workers.

   By focusing on these goals, my country can improve its overall development while ensuring sustainability.

C. Competency-based/Application-based questions.

1. I will take the following measures:
   - Politely request vendors to use paper or cloth bags instead of plastic.
   - Carry my own reusable bags and encourage others to do the same.
   - Explain to vendors how plastic harms the environment and affects human health.
   - Suggest using biodegradable or recycled packaging.
   - Request local authorities to promote awareness campaigns and provide eco-friendly bag alternatives.

2. I will help in the following ways:
   - Educate neighbors about proper waste segregation into dry, wet, and hazardous waste.
   - Encourage the use of separate bins for biodegradable and non-biodegradable waste.
   - Organize a clean-up drive with volunteers in the community.

- Contact the local municipal authorities for proper disposal and recycling.
- Promote composting for biodegradable waste like food scraps and leaves.

3. We can make home manure by following these steps:
   - Collect fruit and vegetable peels, tea leaves, and other organic waste.
   - Put them in a compost bin or a pit in the garden.
   - Add dry leaves or newspaper to balance moisture and airflow.
   - Mix the compost occasionally and keep it slightly moist.
   - After 4-6 weeks, the compost will turn into nutrient-rich manure, which can be used for plants.

▶ **Video Session** (Page 129)

Do it yourself.

Lab Activity (Page 130)

Do it yourself.

Class Activity (Page 130)

Do it yourself.

1. Revisiting AI Project Cycle & Ethical Frameworks for AI

Ai Reboot (Page 140)

1. To achieve a comprehensive understanding, this phase emphasises the use of the 4W's: Who, What, Where, and Why. This approach ensures that all critical components of the problem are clearly defined, aligning stakeholders and team members.

   - **Who:** This step identifies who will be affected from the AI solution, as well as any stakeholders involved in the project. It considers the target audience, users, and decision-makers.

   - **What:** This step defines the specific problem or challenge that needs to be addressed with AI. It outlines the goals and the desired outcome of the project.

   - **Where:** This step focuses on where the AI solution will operate or be implemented. It could refer to the technical environment, the geographical location, or the specific domain.

   - **Why:** This step explores the reason behind solving the problem. It looks at the value and impact that solving the problem will have for the business, users, or society.

2. To turn raw data into visual formats, we can use tools like Excel for simple charts and graphs, Tableau for interactive visuals, and Power BI for detailed reports. In coding, Matplotlib and Seaborn in Python help create bar graphs, pie charts, and heatmaps. These tools make it easier to understand patterns, trends, and relationships in data.

Ai Task (Page 143)

Do it yourself.

Ai GAME 01 (Page 145)

Do it yourself.

Ai GAME 02 (Page 149)

Do it yourself.

Ai GAME 03 (Page 152)

Do it yourself.

▶ **Video Session** (Page 154)

Do it yourself.

Ai GAME 04 (Page 155)

Do it yourself.

Ai Task (Page 158)

Scenario 1:

The car should be programmed to protect human life first. In this case, it should turn and hit the pole to save the child, even if the car gets damaged and the passenger is hurt. AI should also be smart enough to avoid such accidents by sensing danger early. Good programming helps AI make safe and fair choices in tough situations.

Scenario 2:

The manufacturing company and the developer should be held responsible. The developer designed the car's decision-making system, so if the AI failed to prevent the accident, there might be a flaw in the algorithm. The company is responsible for testing and ensuring the car's safety before selling it.

However, if the accident happened because the boy ran into the road suddenly, then it becomes an unavoidable situation, and no one can be fully blamed.

Ai Reboot (Page 160)

1. Utility-based ethical frameworks evaluate actions focusing on maximising overall good, or minimising harm. These frameworks balance benefits and costs to achieve the maximum benefit to the maximum number of people. In context to AI, it may involve the potential benefits of AI applications in the betterment of the human race against the risks like data privacy and biasness, involved in using AI.

2. Rights-based ethical frameworks are based on respecting and upholding individual's rights. These frameworks ensure that all policies and actions focus on basic human rights. In context to AI, it means that AI systems should respect human rights and not discriminate against any specific group.

Exercise

🔒 **Unsolved Questions**

SECTION A (Objective Type Questions)

Ai Quiz

A. 1. d.   2. b   3. b   4. c   5. a   6. b
   7. a   8. d   9. b   10. b

B. 1. text and speech   2. recommendation   3. non-maleficence
   4. Bioethics   5. Data collection   6. Problem scoping
   7. Chatbots   8. Computer vision

C. 1. True   2. True   3. False   4. True   5. False

D. 1. b   2. d   3. e   4. c   5. a

SECTION B (Subjective Type Questions)

A. 1. There are six steps of AI Project cycle : Problem Scoping, Data Acquisition, Data Exploration, Modelling, Evaluation, Deployment.

2. Statistical data is a critical domain of Artificial Intelligence (AI) that focuses on the collection, management, analysis, and interpretation of data systems and processes.

3. Smartphones come with a security system of using facial recognition to lock and unlock smartphones. It uses the front camera and computer vision algorithms to map and store facial features securely. Once it is stored, every time to unlock it matches the input face with the features already stored in it. Face Lock feature belongs to the Computer Vision Domain.

4. The testing phase of the AI project cycle is a critical step where the model's performance is evaluated to ensure it meets the predefined goals and requirements. If the model does not fulfil the required objectives, modifications may be necessary. Once the developer ensures the model achieves satisfactory results and aligns with the project's goals, the AI project proceeds to the deployment phase. This means the project will be transitioned into an operational state, where it is fully implemented and handed over to the end-user for practical use.

5. These frameworks concentrate on essential ethical principles and values such as honesty, respect and fairness that influence decision-making. They are based on different moral beliefs and help us judge whether actions are right or wrong, encouraging ethical behaviour. They are further categorised as:

   • Rights-based ethical frameworks
   • Utility-based ethical frameworks
   • Virtue-based ethical frameworks

B. 1. Some of the applications of computer vision are:

Object detection: Google Lens is an application of Google that can identify objects in images by analysing a photo taken from the real world. It uses the object detection algorithm to recognise and identify an object within images. For example, if you are unaware of the name of a flower in your garden, click a picture with your phone using Google Lens application and it will reveal its name along with the description.

Face lock in smartphones: Smartphones come with a security system of using facial recognition to lock and unlock smartphones. It uses the front camera and computer vision algorithms to map and store facial features securely. Once it is stored, every time to unlock it matches the input face with the features already stored in it.

Self-driving cars: Self-driving cars utilise CV to recognise objects such as lamp posts, pedestrian crossings, and stop signs. Image classification and object detection techniques enable self-driving cars to identify road boundaries, obstacles, and determine actions such as stopping or continuing to drive.

2. The description of these types of ethical frameworks is as follows:

1. Sector-based ethical frameworks: These frameworks focus on an ethical challenge specific to a field or industry. They are trained to focus on a particular sector such as technology, finance or healthcare. For instance, in technology, key considerations include data privacy and the responsible development of AI. In healthcare, the emphasis is on making fair decisions that respect everyone's rights.

   • Bioethics: Bioethics is an interdisciplinary framework used in healthcare to solve tough ethical problems. It combines ideas and principles from fields like medicine, law, and philosophy to help doctors, patients, and researchers make fair and respectful decisions. Bioethics ensures that healthcare decisions are made fairly, respectfully, and in ways that protect everyone's rights. This helps build trust and improve the overall quality of care.

2. Value-based ethical frameworks: These frameworks concentrate on essential ethical principles and values such as honesty, respect and fairness that influence decision-making. They are based on different moral beliefs and help us judge whether actions are right or wrong, encouraging ethical behaviour. They are further categorised as:

   • Rights-based ethical frameworks: These frameworks are based on respecting and upholding individual's rights. These frameworks ensure that all policies and actions focus on basic human rights. In context to AI, it means that AI systems should respect human rights and not discriminate any specific group.

   • Utility-based ethical frameworks: These frameworks evaluate actions focusing on maximising overall good, or minimising harm. These frameworks balance benefits and costs to achieve the maximum benefit to the maximum number of people. In context to AI, it may involve the potential benefits of AI applications in the betterment of human race against the risks like data privacy and biasness, involved in using AI

- Virtue-based ethical frameworks: These frameworks emphasise on the importance of building a strong moral foundation and good character traits such as kindness, compassion and empathy involved in decision making. In context to AI, it would mean that the developers and users of AI should follow ethical virtues throughout the AI project cycle.

These categories offer a clear way to handle ethical issues in AI development and use, making sure that the needs of different sectors and key ethical values are properly considered.

3. Some of the major challenges related to AI are as follows:

- Job loss: Machines and robots powered by AI can replace human workers, which could lead to unemployment. For example, a hotel in Japan called Henn-na hotel started using robots for hospitality resulting in job loss of humans.

- Privacy risks: Many AI-powered devices and apps collect personal information, raising concerns about privacy. For instance, Smartphones had a Face ID feature that used advanced technology to recognise faces. Initially, the phones could be unlocked using a printed photo of the user. However, it has since been upgraded due to privacy concerns.

- AI mistakes: AI systems can make errors that have serious consequences. For example, Uber's self-driving cars ran through red lights during a test, and Microsoft's chatbot Tay started posting offensive messages online shortly after its launch.

- Autonomous weapons: AI is used to create "killer robots" that can make decisions on their own. These weapons are risky because they could be misused or hacked, leading to dangerous situations.

- Bias and discrimination: AI systems learn from data, and if the data is biased, the AI can also become biased. This has caused problems, such as unfair hiring decisions or facial recognition systems not working well for certain groups of people.

- Environmental impact: Running AI systems requires a lot of electricity, which can harm the environment by increasing carbon emissions. This makes it important to consider how we can use AI in a more eco-friendly way.

4. Ethical frameworks provide a valuable tool that help us in dealing with complicated moral issues. They offer a structured approach that assists both individuals and organisational level decision-making by considering their ethical viewpoints. Such a systematic approach guarantees that possible consequences are sensibly assessed and it minimises the risk of unintentional negative results. By adhering ethical frameworks, individuals and organisations can make choices that align with their values, promote beneficial outcomes for all stakeholders, and improve the overall responsibility and ethical decision-making. AI is introducing many great new applications and providing benefits across all areas of our lives. As AI moves from research labs into the real world, more and more people are becoming aware of ethical concerns AI is a powerful tool. It can be used in ways that can affect the society – positively or negatively. For example, electricity or nuclear energy, a lot depends on us - how we utilise AI for humanity.

5. **Data Acquisition:** The next stage in the AI project cycle is known as data acquisition. This stage involves gathering raw data, which is essential for referencing or performing analysis that will guide the project. The process of data acquisition encompasses the collection of a wide range of data types, including text, numerical values, images, videos, and audio. These various forms of data can be sourced from multiple places such as the internet, academic journals, newspapers, and other relevant publications or databases. The goal of data acquisition is to capture accurate and valuable information that reflects real-world scenarios. This collected data serves as a foundation of the project that provides valuable insights and enabling the improvement of the project's performance and the development of more precise AI solutions.

   Data Exploration: Data exploration is a crucial step that involves analysing large volumes of data to uncover meaningful patterns, trends, and relationships using various data visualisation and statistical techniques. By transforming raw data into visual formats such as charts, graphs, and plots, data scientists can more easily interpret and draw insights from the information. This analytical approach not only helps to reveal underlying structures within the dataset but also facilitates the identification of anomalies or irregularities, ultimately laying the groundwork for more informed and effective decision-making in subsequent stages of the AI project.

6. Natural language is the language used by humans to communicate with each other by writing or speaking. Natural Language Processing (NLP) is the domain of artificial intelligence focused on enabling machines to understand, analyse, and interact with humans through natural language. NLP works with two main types of data: text and speech. It combines the fields of linguistics and computer science to analyse language structure and provide guidelines to make models which can comprehend, break down and separate significant details from text and speech. For example, social media platforms like X (formerly Twitter) use NLP to identify and filter out harmful content in user tweets. Amazon uses NLP to analyse customer reviews and improve user experience.

   Some of the real-time applications of NLP are:

   - Plagiarism Checker: It uses NLP to search through online repositories and identify any cases of published content that match your work line by line, warning you about them.

   - Chatbots: Chatbots are software applications that use NLP to communicate with users via text or speech. Smart assistants like Alexa and Siri understand the speech pattern of the instructions and execute them.

7. The need for the ethical framework is given below:

   - Fairness and bias: AI should treat everyone equally. Ethical frameworks help reduce bias in AI, ensuring it do not favour one group over another. This ensures all individuals are given equal opportunities and treatment.

   - Privacy and data protection: AI uses a lot of personal data, so guidelines are needed to protect people's privacy and ensure data is used responsibly. Clear rules help prevent misuse and ensure data security.

- Environmental impact: AI systems can use a lot of energy. Ethical frameworks encourage creating AI that uses less energy and is better for the environment. This ensures that AI doesn't harm the planet while advancing technology.

- Accountability: People are impacted by the decisions made by AI. There need to be methods for comprehending and contesting these choices. This guarantees that AI is responsible for its deeds.

- Transparency and explainability: AI decision-making should be understandable to the general public, particularly in critical domains like healthcare and finance. In addition to building trust, this improves the identification of mistakes.

- Effects on employment: Since AI has the potential to replace some professions, it's critical to support workers by providing them with new skill training. This makes it easier for workers to adjust to changes in the workforce and maintain their jobs.

8. Sector-based ethical frameworks: These frameworks focus on an ethical challenge specific to a field or industry. They are trained to focus on a particular sector such as technology, finance or healthcare. For instance, in technology, key considerations include data privacy and the responsible development of AI. In healthcare, the emphasis is on making fair decisions that respect everyone's rights.

- Bioethics: Bioethics is an interdisciplinary framework used in healthcare to solve tough ethical problems. It combines ideas and principles from fields like medicine, law, and philosophy to help doctors, patients, and researchers make fair and respectful decisions. Bioethics ensures that healthcare decisions are made fairly, respectfully, and in ways that protect everyone's rights. This helps build trust and improve the overall quality of care.

C. **Competency-based/Application-based questions.**

1. A Health Tech company can solve these problems using **bioethics** by:
   - **Protecting Data Privacy:** Keeping health data safe with strong security and getting permission before using it.
   - **Reducing Bias:** Using data from different types of people to make fair predictions.
   - **Being Transparent:** Explaining how the AI makes decisions so people understand the results.
   - **Making It Fair:** Ensuring everyone can use the system, not just certain groups.
   - **Following Rules:** Obeying health laws like HIPAA and GDPR to keep data safe and ethical.

2. **Clear Understanding** – Helps everyone know what the problem is and what needs to be solved.

   Better Solutions – Focuses on key issues, making it easier to find the right solutions.

3. To predict the weather, you need:
   - **Types of Data:** Temperature, humidity, wind speed, air pressure, and rainfall.
   - **Sources:** Weather satellites, sensors, weather stations, and historical weather records.

Assertion and Reasoning Questions.

4. (a) Both A and R are true and R is the correct explanation of A.
5. (b) Both A and R are true but R is not the correct explanation of A.
6. (a) Both A and R are true and R is the correct explanation of A.
7. (a) Both A and R are true and R is the correct explanation of A.

Δi In Life (Page 172)

1. AI is very useful in many areas, like self-driving cars, making products, and helping with decisions. It makes work faster and more accurate, but we should not depend on it for everything. AI can make mistakes or be unfair if it is not trained properly. Some decisions, like medical treatments, legal matters, or safety issues, need human judgment because people understand emotions, fairness, and ethics better than AI. So, while AI is helpful, it is important to keep human control in important decisions to make sure everything is fair, safe, and right.

Δi Deep Thinking (Page 172)

1. AI learning platforms can change how students learn by making lessons fit each student's needs. They can:
   • Give instant feedback to help students improve.
   • Adjust lessons based on how fast or slow a student learns.
   • Offer 24/7 access, so students can learn anytime.

   However, AI cannot fully replace traditional classrooms because:
   • Teachers guide and support students in ways AI cannot.
   • Schools teach teamwork, communication, and social skills that AI cannot provide.
   • Some subjects need hands-on learning (like science experiments).

   So, AI can help learning, but classrooms and teachers are still very important.

2. AI devices like smart assistants and smart thermostats make life easier by:
   • Saving time (e.g., voice assistants answer questions quickly).
   • Saving energy (e.g., smart thermostats adjust temperature automatically).
   • Helping with reminders and daily tasks.

   But AI in homes also has problems, like:
   • Privacy risks – Smart devices collect a lot of personal data.
   • Over-dependence – People may rely too much on AI and forget to do things themselves.

   AI in homes is useful, but we must use it wisely and protect our privacy.

△i Lab (Page 173)

1. **10 Features of Computer Vision:**
   1. Image and Video Processing
   2. Object Detection
   3. Pattern Recognition
   4. Real-time Analysis
   5. Edge Detection
   6. Deep Learning Integration
   7. 3D Vision
   8. Automation in Surveillance
   9. Medical Imaging Enhancement
   10. Cross-Industry Use

   Applications of Computer Vision in Real Life:
   - Facial Recognition
   - Self-driving Cars
   - Medical Diagnosis
   - Augmented Reality (AR)
   - Smart Surveillance

2. Do it yourself.

△i Ready (Page 174) **1**

1. Natural language is the language used by humans to communicate with each other by writing or speaking. Natural Language Processing (NLP) is the domain of artificial intelligence focused on enabling machines to understand, analyse, and interact with humans through natural language. NLP works with two main types of data: text and speech. It combines the fields of linguistics and computer science to analyse language structure and provide guidelines to make models which can comprehend, break down and separate significant details from text and speech. For example, social media platforms like X (formerly Twitter) use NLP to identify and filter out harmful content in user tweets. Amazon uses NLP to analyse customer reviews and improve user experience.

2. Problem scoping is important before setting goals because it helps us understand the problem clearly. It allows us to identify challenges, gather information, and define key requirements before making decisions. Without proper scoping, we might set unrealistic or unclear goals, leading to mistakes. A well-defined problem ensures better planning, accurate solutions, and successful results.

3. An AI project cycle is different from a normal IT project cycle because AI projects need data collection, model training, and continuous learning. In AI, the system learns from data and

improves over time, while IT projects follow fixed rules and coding. AI requires testing and refining models, whereas IT projects focus on building and deploying software with set functions.

4. Respect of Autonomy: Autonomy emphasises the importance of respecting an individual's right to make decisions about their own body and life. It values informed consent, personal choice, and self-determination. For example, a patient has the right to accept or refuse a medical procedure after understanding its risks and benefits.

Beneficence (Maximum Benefits): It involves promoting the well-being and welfare of an individual or society. In other words, it means acting in ways that support the best interests of others. In healthcare, beneficence requires professionals to act in the best interest of their patients by promoting well-being and taking positive actions to prevent harm.

2. Advanced Concepts of Modeling in AI

Ai Reboot (Page 176)

1. It is a subset of Artificial Intelligence that enables machines to learn from data and improve their performance without explicit programming.

2. **AI:** Artificial Intelligence (AI) is a fast-growing technology that allows machines to do tasks that usually need human intelligence, like learning, solving problems, and making decisions. It imitates some abilities of the human brain, such as recognising patterns and understanding information, but it cannot fully match the brain's complexity.

   ML: ML stands for Machine Learning, which is a subset of Artificial Intelligence. It uses statistical methods to enable machines to learn and improve from experience without being explicitly programmed. Machine Learning is one of the most widely used techniques for building AI systems worldwide. It involves teaching machines to interpret, process, and analyse data to solve problems effectively.

Ai Reboot (Page 182)

1. Object Detection and Tracking: Deep learning is used in detecting and tracking pedestrians or vehicles in real-time. Its application can be seen in autonomous vehicles for navigating streets and security systems for monitoring intruders.

   Generative AI: Deep learning is used in generating realistic content that includes images, text, and videos. You may have seen its application in generating DeepFake videos and images.

2. Spam Email Filtering: Machine learning algorithms learn to identify and filter out spam emails by analysing the patterns in sender's email address and content.

▶ **Video Session** (Page 188)

Do it yourself.

🧠 **Δi Task** (Page 189)

Case 1: Supervised Learning

Case 2: Unsupervised Learning

Case 3: Unsupervised Learning

Case 4: Supervised Learning

🧠 **Δi Task** (Page 195)

1. Regression

2. Classification

3. Regression

4. Classification

5. Classification

6. Regression

🤖 **Δi Reboot** (Page 198)

1. a   2. c   3. a   4. c   5. b

Δi GAME 01 (Page 204)

Do it yourself.

Exercise

🔒 **Unsolved Questions**

SECTION A (Objective Type Questions)

Δi Quiz

A. 1. c   2. c   3. a   4. b   5. b   6. c

   7. c   8. c

B. 1. large   2. unsupervised

   3. labelled   4. categorical, continuous

   5. features   6. Artificial neural networks

   7. AI model   8. hidden layer

C. 1. True   2. False   3. False   4. True   5. True   6. False

SECTION B (Subjective Type Questions)

A. 1. The main drawback of this approach is that the machine's learning is static. Once trained, the machine does not adapt to changes made in the original training dataset. If the machine is tested on a dataset that differs from the rules and data provided during the training stage, it will fail to produce accurate results and will not learn or adjust to the new conditions it encounters.

2. The major advantage of the learning-based approach over the rule-based approach is its adaptability—it can dynamically learn from data, recognize patterns, and improve over time without manual updates, making it more flexible and scalable.

3. Classification: It's a supervised learning technique that assigns data points to predefined categories or labels. Labelled data is fed to the model. For example, classifying emails as "Spam" or "Not Spam."

   Clustering: It is an unsupervised learning technique used to group similar data points into clusters. The input data is unlabelled data. For example, grouping customers based on shopping behaviour to target personalised marketing.

4. The Convolutional Neural Network is part of the Neural Networks that is primarily used for image related tasks. It extracts spatial features from data. It is used in Image classification (e.g., object detection), Medical imaging (e.g., tumor detection), Facial recognition, Autonomous vehicles, etc.

5. The testing data set is a collection of data provided to a machine learning model to evaluate how well it has learned to make predictions.

6. Real-world applications of Neural Networks are fraud detection, recommendation system, facial recognition, chatbots and virtual assistant, etc.

B. 1. ANN is made up of three basic layers – Input, Hidden and Output. The input layer accepts the inputs, the hidden layer processes the inputs, and the output layer produces the result where each layer tries to learn from the computed weights. It is the foundation of AI and is used to solve complex problems that are difficult for humans. It consists of hardware or software that operates just like neurons of the human brain. Commercial application of ANN is in solving complex signal processing, predictions or pattern recognition problems.

2. • Recommendation Systems: These are a classic example of Machine Learning in real world. These systems analyse user's data, such as preferences, behaviour, or past interactions, to suggest personalised options. The platforms, like Netflix, Flipkart, Spotify, etc. use such kind of recommendation systems to help their customers to find the related products.

   • Spam Email Filtering: Machine learning algorithms learn to identify and filter out spam emails by analysing the patterns in sender's email address and content.

   • Image Recognition: When you upload a picture, an automatic tag recognition system used by applications like Facebook, suggests people to tag. It uses a face recognition algorithm for the same.

- Speech Recognition: We all love to speak out our messages to Siri, Google assistant, Amazon Alexa etc. These speech recognition devices use machine learning to understand spoken language and convert speech to text and respond accordingly.

3.

Aspect	Supervised Learning	Unsupervised Learning
Data	Uses labelled datasets with input-output pairs (e.g., images labelled as "cat" or "dog").	Uses unlabelled datasets without predefined categories.
Goal	To predict the output for new, unseen data based on the labels provided during training.	To explore data and find hidden patterns or groupings.
Common Techniques	Classification, Regression	Clustering, Dimensionality Reduction
Examples	- Predicting house prices based on features like area and location. - Classifying emails as "spam" or "not spam".	- Grouping customers into segments based on their purchase behaviour. - Detecting anomalies in network traffic.
Output	Predicts specific labels or values for new data.	Groups data into clusters or finds patterns, without specific labels.

4. Association is an unsupervised learning method that is used to find interesting relationships or patterns among variables in a dataset. It is widely employed to identify relationships between items, sets frequently purchased items together in large databases, helping to analyse how items or events are related to each other.

Consider an example of the items purchased by customers: Consider a supermarket example wherein

- Customer A buys bread, butter, and milk
- Customer B buys rice, bread, and butter

Based on the purchase pattern of customers A and B, can you predict any Customer X who buys bread will most probably buy?

In this case, we might discover an association rule such as: "If customer A buys 'Milk', they are likely to buy 'Cereal' or 'Bread'." Therefore, such meaningful associations can be useful to recommend items to customers. This is called Association rule.

5. Regression algorithms predict a continuous value based on the input variables. It is an example of a rule-based AI model. In regression, the algorithm generates a mapping function from

the data, as shown by the solid line in the given graph. The green dots shown in the graph are the data values and the solid line here represents the mapping done for them. With the help of this mapping function, we can predict the future data.

For example, if we want to predict the temperature of a day in a year, we can use past year's temperature for that day as training data and can predict it for the coming year. Regression is a mathematical approach to find a relationship between two or more variables. It works with continuous data. This can be used for weather forecasting, time series modelling, etc. In order to get the best fit results, the distance between the line and data points should be minimum.

C. <mark>**Competency-based/Application-based questions.**</mark>

1. Identify the type of learning (supervised, unsupervised, reinforcement learning) for the following case studies:
   a. **Supervised Learning** – The company has historical rental data with labeled prices.
   b. **Reinforcement Learning** – The system learns by interacting with players and receiving rewards/penalties.
   c. **Reinforcement Learning** – The robot receives feedback through rewards and penalties.
   d. **Supervised Learning** – The company has labeled data of legitimate and fraudulent transactions.
   e. **Unsupervised Learning** – The library analyzes book loan patterns without predefined labels.

2. A retail store's dataset tasks:
   a. **Supervised Learning (Classification)** – Predicting whether a customer will make a purchase.
   b. **Supervised Learning (Regression)** – Forecasting total revenue.
   c. **Unsupervised Learning (Clustering)** – Segmenting customers based on behavior.
   d. **Unsupervised Learning (Association Rules)** – Discovering frequently purchased product combinations.

3. Identify the type of learning for the following case studies:

   Case Study 1: Supervised Learning – The dataset includes labeled examples of customers who churned.

   Case Study 2: Unsupervised Learning – Grouping users based on interests without predefined categories.

   Case Study 3: Reinforcement Learning – The autonomous vehicle learns through rewards and penalties.

   Case Study 4: Unsupervised Learning – Identifying patient data patterns without predefined treatment labels.

Case Study 5: Supervised Learning – Detecting anomalies with labeled examples of normal and abnormal behavior.

4. Identify the type of model (classification, regression, clustering, association model) for the following case studies:

   a. **Classification** – Predicting whether a loan applicant will default (binary outcome).

   b. **Regression** – Predicting house prices (continuous outcome).

   c. **Clustering** – Segmenting customers into distinct groups.

   d. **Association Model** – Identifying frequently bought-together products.

5. Convert the following scenarios to perceptron:

   a. **Healthcare provider tasks:**

      (i)   Classification – Predicting short or long hospital stays.

      (ii) Regression – Predicting the number of hospital stay days.

      (iii) Clustering – Segmenting patients based on characteristics.

      (iv) Association Model – Identifying patterns in treatments and outcomes.

      (v)   The types of models are classification, regression, clustering, and association models as listed above.

   b. **Homeowner decision for solar panels:** A perceptron can be designed with binary input features (Yes = 1, No = 0) for each factor. The perceptron would process these inputs and output a decision (Invest or Not Invest).

   Assertion and Reasoning Questions:

6. (a) Both A and R are true and R is the correct explanation of A.

7. (a) Both A and R are true and R is the correct explanation of A.

Δi In Life (Page 216)

Deep Learning and Natural Language Processing (NLP) have transformed communication by making interactions more efficient and accessible. Voice assistants like Siri and Alexa use NLP to understand and respond to human speech. In healthcare, NLP-powered chatbots assist in diagnosing symptoms, improving patient care. These technologies break language barriers, enhance customer service, and streamline operations across industries.

Δi Deep Thinking (Page 216)

1. If I were creating a robot to be the security in-charge of my school, it would need to pass several tests to ensure it is safe for students and staff. Here are some hurdles the robot must clear before it is ready:

   1. **Student Safety Test** – The robot should never harm or scare students. It must recognize students and staff and know the difference between normal activities and actual threats.

2. **Decision-Making Test** – Since the robot can think on its own, it must make the right choices in different situations. For example, if a student is running, it should not mistake it for an emergency.

3. **Emergency Response Test** – The robot should know what to do in real emergencies like fires, fights, or unauthorized visitors. It must alert the right people without causing panic.

4. **Respecting Privacy** – The robot should not invade students' privacy. It must follow school rules about when and where it can record or monitor activities.

5. **Communication Skills** – The robot should be able to talk in a friendly and clear way so students can understand its instructions without fear.

6. **Battery and Maintenance Check** – The robot should work properly for long hours without suddenly shutting down. It must also be easy to repair if something goes wrong.

7. **Hacking Protection** – The robot must be secure against hacking attempts to prevent misuse or malfunction.

By passing these tests, the robot can be trusted to keep the school safe while ensuring students feel comfortable around it.

Δi Lab (Page 216)

1. By experimenting on TensorFlow Playground, I learned that activation functions like ReLU help in deep networks, while sigmoid and tanh can slow learning. More hidden layers and neurons help the model learn better but can also cause overfitting. The learning rate controls how fast the model improves—a high rate makes learning faster but less stable, while a low rate is slower but more accurate. Finding the right balance is important for good performance.

2. Do it yourself.

3. Do it yourself.

Class Activity (Page 219)

1. The given image represents wind speed and direction data at different times of the day. Based on this, the best-suited supervised learning models are:

   1. Regression Model (Linear Regression or Decision Tree Regression)
      • Reason: The data involves predicting wind speed at different times, which is a continuous numerical value. Regression models help analyze trends and make predictions based on past wind speed patterns.

   2. Classification Model (Random Forest or Logistic Regression)
      • Reason: If the task involves categorizing wind conditions (e.g., low, moderate, or high wind speed), classification models can be useful. These models can learn from past data and classify wind speeds into different categories.

3. Time Series Model (Recurrent Neural Network or ARIMA)
   - Reason: Since wind speed varies over time, time series models can analyze patterns and make accurate future predictions based on sequential data.
2. Do it yourself.

Δi Ready (Page 220) **2**

1. Artificial Neural Networks (ANN): It is artificially created efficient computing systems designed to simulate the human brain. It includes machine learning as part of Artificial Intelligence. An ANN in its training phase is capable of learning by recognising patterns in data which is later used to generate the desired output. ANN is made up of three basic layers – Input, Hidden and Output. The input layer accepts the inputs, the hidden layer processes the inputs, and the output layer produces the result where each layer tries to learn from the computed weights. It is the foundation of AI and is used to solve complex problems that are difficult for humans. It consists of hardware or software that operates just like neurons of the human brain. Commercial application of ANN is in solving complex signal processing, predictions or pattern recognition problems.

   Convolutional Neural Networks (CNN): The Convolutional Neural Network is part of the Neural Networks that is primarily used for image related tasks. It extracts spatial features from data. It is used in Image classification (e.g., object detection), Medical imaging (e.g., tumor detection), Facial recognition, Autonomous vehicles, etc.

2. Income Prediction: Predict a person's annual income based on demographics. The model is trained with input features like age, education, hours per week, it can take value within a specific range. The output is a continuous value, annual income of a person.

3. Association is an unsupervised learning method that is used to find interesting relationships or patterns among variables in a dataset. It is widely employed to identify relationships between items, sets frequently purchased items together in large databases, helping to analyse how items or events are related to each other.

4. Artificial Neural Networks (ANN): It is artificially created efficient computing systems designed to simulate the human brain. It includes machine learning as part of Artificial Intelligence. An ANN in its training phase is capable of learning by recognising patterns in data which is later used to generate the desired output. ANN is made up of three basic layers – Input, Hidden and Output. The input layer accepts the inputs, the hidden layer processes the inputs, and the output layer produces the result where each layer tries to learn from the computed weights. It is the foundation of AI and is used to solve complex problems that are difficult for humans. It consists of hardware or software that operates just like neurons of the human brain. Commercial application of ANN is in solving complex signal processing, predictions or pattern recognition problems.

   Convolutional Neural Networks (CNN) The Convolutional Neural Network is part of the Neural Networks that is primarily used for image related tasks. It extracts spatial features from data. It is used in Image classification (e.g., object detection), Medical imaging (e.g., tumor detection), Facial recognition, Autonomous vehicles, etc.

3. Evaluating Models

Ai Reboot (Page 225)

1. Overfitting, Underfitting, Perfect Fit
2. The model (purple line) is too simplistic, failing to capture the pattern in both the training and testing data. It has high bias and low variance. The model fails to capture the underlying patterns in the data.

Ai Task (Page 226)

Predicted Salary	Actual Salary	Error Absolute	Error Rate	Accuracy	Accuracy%
47,000	45,000	2,000	0.044	0.956	95.6%
56000	56500	500	0.009	0.991	99.1%
45,000	45,500	500	0.011	0.989	98.9%
38000	37000	1000	0.027	0.973	97.3%
65000	67,000	2000	0.030	0.970	97.0%

The mean accuracy of all five samples is **97.6%**.

Ai Task (Page 236)

No, good precision alone does not mean a model performs well. Precision measures how many of the predicted positive results are actually correct, but it does not consider false negatives. A model with high precision but low recall may miss many actual positive cases, reducing overall effectiveness.

▶ **Video Session** (Page 239)

Do it yourself.

Exercise

🔒 **Unsolved Questions**

SECTION A (Objective Type Questions)

Ai Quiz

A.
1. b
2. c
3. a
4. d
5. b
6. b
7. a
8. b
9. c
10. b
11. a
12. c

B.
1. Overfitting
2. Recall
3. tabular
4. Negative
5. actual
6. precision
7. generalization
8. training, testing
9. reliable
10. precision, recall

C. 1. b   2. a   3. c   4. d

D. 1. False   2. True   3. False   4. True   5. True

SECTION B (Subjective Type Questions)

A. 1. Classification is the task of "classifying things" into sub-categories. Classification is part of supervised machine learning in which we put labelled data for training. For example, You and your friends go to a restaurant, where pure vegetarians sit together at one table and non-vegetarians sit together at another table, to ensure that there is no confusion while serving food.

2. It is suitable wherever the dataset is balanced, which means the positive and negative classes are roughly equal, that is a rare occurrence, and that all predictions and prediction errors are equally important, which is often not the case.

3. Precision of the model is an important aspect for evaluation. So, if the Precision is more, that would mean that False Positive cases are less than the True Positive cases.

   In email spam detection, False Positives can be costly, leading to missed business opportunities or communication breakdowns. Precision is critical when the cost of a False Positive is high, such as in fraud detection systems where unnecessary transaction rejections can cause inconvenience to customers.

4. A high F1 score means the model has low False Positives (FP) and low False Negatives (FN)—meaning it correctly identifies real cases and minimizes false alarms. It is particularly useful in real-life classification problems, especially when dealing with imbalanced datasets (where one class is much more frequent than the other).

5. Splitting the training set data is a crucial step in model evaluation, allowing for a systematic assessment of the model's performance by creating distinct datasets for training, validation, and testing. Let's learn more about splitting the training set using the Train-Test split in detail.

B. 1. **Accuracy**

   Definition: Accuracy measures the overall correctness of a model by calculating the ratio of correctly classified instances to the total instances.

   Formula:

   $$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

   Example: A spam detection system analyzes 200 emails. It correctly classifies 90 spam emails and 80 non-spam emails, but misclassifies 20 emails. Accuracy = (90 + 80) / 200 = 85%. Accuracy is useful when the dataset is balanced but misleading in imbalanced cases.

   Precision

   Definition: Precision indicates how many of the predicted positive cases are actually correct. It helps reduce False Positives.

Formula:

$$\text{Precision} = \frac{TP}{TP + FP}$$

Example: A fraud detection model flags 30 transactions as fraudulent, but 10 are actually genuine. Precision = 20 / (20 + 10) = **66.7%**. Precision is crucial in applications where False Positives have serious consequences, such as legal or financial decisions.

Recall (Sensitivity)

Definition: Recall measures how well the model identifies actual positive cases, focusing on reducing False Negatives.

Formula:

$$\text{Recall} = \frac{TP}{TP + FN}$$

Example: A cancer screening model detects 40 cancer patients but misses 10 cases.

Recall = 40 / (40 + 10) = 80%. High recall is essential in healthcare and security applications to avoid missing important cases.

F1 Score

Definition: The F1 Score is the harmonic mean of Precision and Recall, balancing both metrics.

Formula:

$$\text{F1 Score} = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

Example: A medical diagnosis model has **Precision = 70%** and **Recall = 80%**. F1 Score = 2 × (0.7 × 0.8) / (0.7 + 0.8) = **74.3%**. The F1 Score is valuable when Precision and Recall need to be balanced, such as in spam detection or medical diagnosis.

Each metric should be chosen based on the problem's priority—accuracy for balanced data, precision to reduce False Positives, recall to minimize False Negatives, and F1 Score when both matter equally.

2. Precision and Recall are trade-offs; the choice depends on the problem.

Precision is crucial when False Positives must be minimized. In fraud detection, a high-precision model ensures legitimate transactions aren't wrongly blocked. Similarly, in spam filtering, high precision prevents important emails from being marked as spam.

Recall is essential when False Negatives are critical. In medical diagnoses, missing a disease (False Negative) can be life-threatening. Similarly, in security systems, failing to detect a threat can have serious consequences.

If both False Positives and False Negatives matter, the **F1 Score** provides a balanced approach.

Ultimately, the choice depends on whether **minimizing False Positives (Precision)** or **minimizing False Negatives (Recall)** is more important for the specific application.

3. Overfitting Model: The model (red curve) fits the training data perfectly, including noise, but performs poorly on the testing data, leading to poor generalisation. In overfitting, the model is too complex and performs well on training data but poorly on test data. It has low bias and high variance. The model memorizes the training data but struggles to generalise to new, unseen data.

Underfitting Model: The model (purple line) is too simplistic, failing to capture the pattern in both the training and testing data. It has high bias and low variance. The model fails to capture the underlying patterns in the data.

4. Model evaluation is the process of applying various metrics to assess a machine learning model's performance. AI model improves overtime with constructive feedback. This is an iterative process where you build the model, evaluate its performance using appropriate metrics, refine it based on the feedback, and repeat until the desired accuracy is achieved. It's similar to tuning a musical instrument—regularly checking its sound quality, making adjustments, and fine-tuning until the melody is harmonious and meets the desired standard.

Different techniques used to evaluate classification models:

1. **Confusion Matrix:** A confusion matrix provides a summary of predictions, showing True Positives (TP), True Negatives (TN), False Positives (FP), and False Negatives (FN). It helps compute metrics like Accuracy, Precision, Recall, and F1 Score.

2. **Accuracy:** Measures the overall correctness of predictions:

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

Useful for balanced datasets but misleading for imbalanced ones.

3. **Precision, Recall, and F1 Score**
   - **Precision:** Focuses on minimizing False Positives.
   - **Recall:** Focuses on minimizing False Negatives.
   - **F1 Score:** Balances both, useful in imbalanced data.

C. **Competency-based/Application-based questions.**

1. We have the following values from the problem:
   - True Positives (TP) = 90
   - False Positives (FP) = 40
   - True Negatives (TN) = 820
   - False Negatives (FN) = 50

   1. **Accuracy:** Accuracy measures the proportion of correctly classified instances out of the total instances.

      Formula:

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

Calculation:

$$\text{Accuracy} = \frac{90 + 820}{90 + 820 + 40 + 50}$$

$$= 910 / 1000$$

$$= 0.91 \ (91\%)$$

2. **Precision:** Precision (Positive Predictive Value) measures how many of the predicted positives are actually correct.

   Formula:

   $$\text{Precision} = \frac{TP}{TP + FP}$$

   Calculation:

   $$\text{Precision} = \frac{90}{90 + 40}$$

   $$= 90 / 130$$

   $$\approx 0.692 \ (69.2\%)$$

3. **Recall (Sensitivity or True Positive Rate):** Recall measures how many actual positive cases were correctly predicted.

   Formula:

   $$\text{Recall} = \frac{TP}{TP + FN}$$

   Calculation:

   $$\text{Recall} = \frac{90}{90 + 50}$$

   $$= 90 / 140$$

   $$\approx 0.643 \ (64.3\%)$$

4. **F1-Score:** F1-score is the harmonic mean of Precision and Recall, balancing both metrics.

   Formula:

   $$\text{F1 Score} = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

   Calculation:

   $$\text{F1 Score} = 2 \times \frac{0.692 \times 0.643}{0.692 + 0.643}$$

   $$= 2 \times (0.4449) / 1.335$$

   $$\approx 0.666 \ (66.6\%)$$

Final Results:

- Accuracy: **91%**
- Precision: **69.2%**
- Recall: **64.3%**
- F1-score: **66.6%**

Assertion and Reasoning questions.

2. (d) A is incorrect, but R is correct.
3. (a) Both A and R are correct, and R is the correct explanation of A.
4. (c) A is correct, but R is incorrect.

🤖 Δi In Life (Page 249)

Application of Evaluation Techniques in Education

Evaluation techniques help assess the effectiveness of educational programs by measuring student engagement, learning outcomes, and course effectiveness.

Methods to Gather Data and Measure Learning Outcomes:

1. **Pre- and Post-Assessments** – Conducting tests before and after a course to measure knowledge gain.
2. **Surveys and Feedback Forms** – Collecting qualitative insights from students and teachers.
3. **Attendance and Participation Tracking** – Measuring student engagement in online discussions, quizzes, and live sessions.
4. **Assignment and Exam Performance** – Analyzing grades to assess comprehension and application of knowledge.
5. **Dropout and Completion Rates** – Evaluating course retention and student commitment.

🧠 Δi Deep Thinking (Page 249)

Clickstream Data Analysis – Tracking login frequency, time spent on content, and interactions.

1. **Quiz Scores and Assignment Submissions** – Assessing student progress.
2. **Engagement Metrics** – Discussion forum activity, video watch time, and participation in live sessions.
3. **Completion Rates** – Determining the percentage of students finishing the course.
4. **AI-Based Learning Analytics** – Identifying struggling students based on real-time data.

💻 Δi Lab (Page 249)

1. One notable example of natural disaster prediction is the European Flood Awareness System (EFAS), which aims to provide early warnings for potential flooding events across Europe.

Prediction-Reality Comparison:

Consider a scenario where EFAS issued flood warnings for a particular region. To evaluate the system's performance, we compare the predictions against the actual occurrences:

- **True Positives (TP):** EFAS correctly predicted 15 flood events that occurred.
- **False Positives (FP):** EFAS predicted 5 flood events that did not occur.
- **True Negatives (TN):** EFAS correctly identified 70 instances where no floods occurred.
- **False Negatives (FN):** EFAS missed 2 flood events that did occur.

	Predicted Flood	**Predicted No Flood**
Actual Flood	TP = 15	FN = 2
Actual No Flood	FP = 5	TN = 70

2. **Evaluation Metrics:**

- **Accuracy:**

$$= \frac{TP + TN}{TP + FP + TN + FN}$$

$$= \frac{50 + 70}{15 + 5 + 70 + 2}$$

$$= \frac{85}{92}$$

$$\approx 0.923 \ (92.3\%)$$

- **Precision:**

$$= \frac{TP}{TP + FP}$$

$$= \frac{15}{15 + 5}$$

$$= \frac{15}{20}$$

$$= 0.75 \ (75\%)$$

- **Recall (Sensitivity):**

$$= \frac{TP}{TP + FN}$$

$$= \frac{15}{15 + 2}$$

$$= \frac{15}{17}$$

$$\approx 0.882 \ (88.2\%)$$

- **F1 Score:**

$$= 2 \times \frac{Precision \times Recall}{Precision + Recall}$$

$$= 2 \times \frac{0.75 \times 0.882}{0.75 + 0.882}$$

$$\approx 0.811 \ (81.1\%)$$

These metrics indicate that EFAS has a high accuracy and recall, suggesting it effectively identifies most flood events. However, the precision is slightly lower, indicating some false alarms. The F1 Score provides a balanced measure of the system's precision and recall.

3. **Evaluation Metrics Calculation**

- **Accuracy:**

$$= \frac{TP + TN}{TP + TN + FP + FN}$$

$$= \frac{100 + 320}{100 + 320 + 45 + 65}$$

$$= \frac{420}{530}$$

$$\approx \textbf{79.2\%}$$

- **Precision:**

$$= \frac{TP}{TP + FP}$$

$$= \frac{100}{100 + 45}$$

$$= \frac{100}{145}$$

$$\approx \textbf{68.9\%}$$

- **Recall:**

$$= \frac{TP}{TP + FN}$$

$$= \frac{100}{100 + 65}$$

$$= \frac{100}{165}$$

$$\approx \textbf{60.6\%}$$

- **F1 Score:**

$$= 2 \times \frac{Precision \times Recall}{Precision + Recall}$$

$$= 2 \times \frac{0.689 \times 0.606}{0.689 + 0.606}$$

$$= 2 \times \frac{0.4177}{1.295}$$

$$\approx \textbf{64.5\%}$$

Class Activity (Page 250)

1. **Case Study 1:** Spam Email Detection System

Confusion Matrix

	Predicted Spam (1)	**Predicted Not Spam (0)**
Actual Spam (1)	TP = 150	FN = 50
Actual not Spam (0)	FP = 50	TN = 750

Evaluation Metrics

- **Accuracy** $= \dfrac{TP + TN}{TP + FP + TN + FN}$

$= \dfrac{150 + 750}{150 + 50 + 750 + 50}$

$= \dfrac{900}{1000}$

$= \textbf{0.90 (90\%)}$

- **Precision** $= \dfrac{TP}{TP + FP}$

$= \dfrac{150}{150 + 50}$

$= \dfrac{150}{200}$

$= \textbf{0.75 (75\%)}$

- **Recall** $= \dfrac{TP}{TP + FN}$

$= \dfrac{150}{150 + 50}$

$= \dfrac{150}{200}$

$= \textbf{0.75 (75\%)}$

- **F1 Score** $= 2 \times \dfrac{Precision \times Recall}{Precision + Recall}$

$= 2 \times \dfrac{0.75 \times 0.75}{0.75 + 0.75}$

$= 2 \times \dfrac{0.5625}{1.5}$

$= \textbf{0.75 (75\%)}$

Case Study 2: Fraud Detection System

Confusion Matrix

	Predicted Fraudulent (1)	**Predicted Legitimate (0)**
Actual Fraudulent (1)	TP = 80	FN = 40
Actual Legitimate (0)	FP = 30	TN = 850

Evaluation Metrics

- **Accuracy** $= \dfrac{TP + TN}{TP + FP + TN + FN}$

$= \dfrac{80 + 850}{80 + 30 + 850 + 40}$

$$= \frac{930}{1000}$$

$$= \textbf{0.93 (93\%)}$$

- **Precision** $= \dfrac{TP}{TP + FP}$

$$= \frac{80}{80 + 30}$$

$$= \frac{80}{110}$$

$$= \textbf{0.727 (72.7\%)}$$

- **Recall** $= \dfrac{TP}{TP + FN}$

$$= \frac{80}{80 + 40}$$

$$= \frac{80}{120}$$

$$= \textbf{0.667 (66.7\%)}$$

- **F1 Score** $= 2 \times \dfrac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$

$$= 2 \times \frac{0.727 \times 0.667}{0.727 + 0.667}$$

$$= 2 \times \frac{0.485}{1.394}$$

$$= \textbf{0.696 (69.6\%)}$$

Case Study 3: Medical Diagnosis System

Confusion Matrix

	Predicted Disease (1)	**Predicted No Disease (0)**
Actual Disease (1)	TP = 120	FN = 60
Actual No Disease (0)	FP = 20	TN = 800

Evaluation Metrics

- **Accuracy** $= \dfrac{TP + TN}{TP + FP + TN + FN}$

$$= \frac{120 + 800}{120 + 20 + 800 + 60}$$

$$= \frac{920}{1000}$$

$$= \textbf{0.92 (92\%)}$$

- **Precision** $= \dfrac{TP}{TP + FP}$

$$= \frac{120}{120 + 20}$$

$$= \frac{120}{140}$$

$$= \textbf{0.857 (85.7\%)}$$

- **Recall** $= \dfrac{TP}{TP + FN}$

$$= \frac{120}{120 + 60}$$

$$= \frac{120}{180}$$

$$= \textbf{0.667 (66.7\%)}$$

- **F1 Score** $= 2 \times \dfrac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$

$$= 2 \times \frac{0.857 \times 0.667}{0.857 + 0.667}$$

$$= 2 \times \frac{0.571}{1.524}$$

$$= \textbf{0.75 (75\%)}$$

Case Study 4: Inventory Management System

Confusion Matrix

	Predicted Out of Stock (1)	**Predicted In Stock (0)**
Actual Out of Stock (1)	TP = 100	FN = 50
Actual In Stock (0)	FP = 50	TN = 800

Evaluation Metrics

- **Accuracy** $= \dfrac{TP + TN}{TP + FP + TN + FN}$

$$= \frac{100 + 800}{100 + 50 + 800 + 50}$$

$$= \frac{900}{1000}$$

$$= \textbf{0.90 (90\%)}$$

- **Precision** $= \dfrac{TP}{TP + FP}$

$$= \frac{100}{100 + 50}$$

$$= \frac{100}{150}$$

$$= \textbf{0.667 (66.7\%)}$$

- **Recall** $= \dfrac{TP}{TP + FN}$

  $= \dfrac{100}{100 + 50}$

  $= \dfrac{100}{150}$

  $= $ **0.667 (66.7%)**

- **F1 Score** $= 2 \times \dfrac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$

  $= 2 \times \dfrac{0.667 \times 0.667}{0.667 + 0.667}$

  $= 2 \times \dfrac{0.444}{1.334}$

  $= $ **0.667 (66.7%)**

Summary of Evaluation Metrics

Case Study	Accuracy	Precision	Recall	F1 Score
Spam Detection	90%	75%	75%	75%
Fraud Detection	93%	72.7%	66.7%	69.6%
Medical Diagnosis	92%	85.7%	66.7%	75%
Inventory Management	90%	66.7%	66.7%	66.7%

Each case study shows different strengths and weaknesses based on the precision-recall tradeoff. For instance:

- The **Medical Diagnosis System** has the **highest precision**, meaning fewer false positives.
- The **Fraud Detection System** has **moderate recall**, meaning it detects a fair number of fraudulent transactions but still misses some.
- The **Spam Detection System** and **Inventory Management System** have balanced recall and precision.

Ai Ready (Page 251) **3**

1. Accuracy measures the overall correctness of a model by calculating the ratio of correctly classified instances to the total instances.

   Formula:

   $$\text{Accuracy} = \dfrac{TP + TN}{TP + TN + FP + FN}$$

Contribution: Accuracy measures overall correctness but may be misleading for imbalanced datasets. In ethical AI applications like hiring or medical diagnosis, relying solely on accuracy can overlook biases.

Precision indicates how many of the predicted positive cases are actually correct. It helps reduce False Positives.

Formula:

$$\text{Precision} = \frac{TP}{TP + FP}$$

Contribution: Precision is crucial when false positives need to be minimized, such as in spam detection or fraud detection, ensuring reliability by reducing incorrect classifications.

Recall measures how well the model identifies actual positive cases, focusing on reducing False Negatives.

Formula:

$$\text{Recall} = \frac{TP}{TP + FN}$$

Contribution: High recall ensures that most actual positives are identified, making it essential in healthcare (e.g., detecting diseases) where missing a positive case can have severe consequences.

The F1 Score is the harmonic mean of Precision and Recall, balancing both metrics.

Formula:

$$\text{F1 Score} = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

Contribution: F1 Score balances precision and recall, providing a fair assessment when false positives and false negatives are equally important, ensuring ethical and fair decision-making.

2. AI (Artificial Intelligence) is the simulation of human intelligence in machines, enabling them to learn, reason, and make decisions.

   Evaluation is the key step in the AI project cycle where the effectiveness, accuracy, and reliability of the model are assessed to ensure it meets the project objectives and performs well in real-world scenarios. After the designing of an AI model, it is important to evaluate the model to see that the model is designed as per the need and is giving the desired process.

3. It is the evaluation phase of the AI project cycle, where we check whether the model can achieve required goals or not. If the model fails to meet the requirements, we can modify either the model or the data. Once the developer feels it is deployed in a real-world environment and handed over to the user. If the deployment stage is not reached, the project is of no use.

4. Statistical Data (Practical)

Ai Task (Page 253)

Do it yourself.

Ai Task (Page 255)

Here are the unscrambled words along with their meanings:

1. **MACHINE LEARNING** – A branch of AI that enables computers to learn patterns from data and make predictions or decisions.
2. **DATA SCIENCE** – The field that involves extracting insights from data using AI, statistics, and machine learning.
3. **TARGETED ADVERTISING** – AI-driven personalized ads based on user behavior and preferences.
4. **CHATBOT ASSISTANTS** – AI-powered virtual assistants that interact with users and provide automated responses.
5. **RECOMMENDATIONS** – AI-based suggestion systems used in platforms like Netflix, Amazon, and YouTube.

Ai Task (Page 256)

The best approach for our customer support chatbot depends on the goal. If we want quick, rule-based responses for common questions, a **rule-based chatbot** is best. But if we need the chatbot to understand natural language, learn from interactions, and handle complex queries, an **AI-powered chatbot** is the better choice. AI chatbots improve over time, provide personalized responses, and handle a wider range of customer issues, making them more effective for support.

▶ **Video Session** (Page 259)

Do it yourself.

Ai Reboot (Page 262)

1. Orange Data Mining was developed at the University of Ljubljana, Slovenia. It was first released in the 1990s by the Bioinformatics Laboratory at the Faculty of Computer and Information Science.
2. In a right-skewed distribution, most of the data is clustered on the left (lower values), while the tail extends to the right (higher values).

Ai Task (Page 262)

Do it yourself.

Ai Task (Page 266)

Do it yourself.

Ai Reboot (Page 271)

1. Unsupervised widgets help to apply unsupervised learning models to our data and visualise it. Unsupervised learning refers to the type of machine learning where the model is given data without labeled outcomes (i.e., no target variable). This will help in finding the hidden patterns or structure in the data.

2. It shows how the model makes predictions on new, unseen data. It provides predicted labels or values for the test data and compares them with the actual values to assess the model's accuracy

3. It is used to convert continuous data (like numbers) into categories (like groups or ranges), making it easier for certain machine learning models to process and understand the data.

4. It creates an ensemble of decision trees (a forest of trees). Instead of using just one decision tree, it combines multiple trees to make more accurate predictions.

Exercise

🔒 Unsolved Questions

SECTION A (Objective Type Questions)

Ai Quiz

A. 1. b 2. b 3. b 4. b 5. a 6. b
   7. b 8. a 9. c 10. d

B. 1. Data Science is used in various fields for different purposes:
   - Internet Search
   - Targeted Advertising
   - Website Recommendations

2. Data science is revolutionizing the fields of genetics and genomics, enabling scientists to analyse genes and DNA with unprecedented accuracy. By analysing genetic data alongside lifestyle, environment, and medical history, researchers can understand how genes affect health and disease. This enables personalised treatments for conditions like cancer, diabetes, and heart disease. Data Science also predicts genetic risks, identifying who might be prone to specific illnesses based on their DNA.

3. Data widgets are essential components that help you interact with, manipulate, and visualise your data. These widgets allow you to load datasets, explore data, preprocess it, and apply machine learning algorithms.

4. An outlier is a data point that is significantly different from the other points in the dataset. It's an "exceptional" value that is much higher or lower than most of the other values.

5. Probability deals with the likelihood or chance of an event happening. It helps us understand how likely or unlikely something is to occur based on known information. In simple terms, probability answers the question: "How likely is this event going to happen? An event is the outcome of an experiment. Events can be either independent or dependent.

6. Lobe is a simple, no-code tool created by Microsoft in 2015. It helps users build and train machine learning models without any coding skills. It's designed for people who want to create AI models for tasks like image classification, but don't have a background in programming or data science. Lobe automatically trains models based on uploaded images and allows users to export trained models for deployment.

7. • It allows users to build ML models without having to write any code.
    • It simplifies the process of using machine learning by providing a visual, drag-and-drop interface along with tools that support the entire machine learning lifecycle, from data preparation to model deployment.
    • Whether you're a beginner with no coding experience or an experienced

8. a. It is an open-source, user-friendly data analysis and machine learning software suite.
    b. It provides a wide range of tools for data mining, machine learning, data visualization, and statistical analysis.
    c. Orange is designed to be accessible to both beginners and advanced users, and it is especially popular for those interested in exploring and analysing data with a visual programming interface.

9. Model widgets are used to create, train, and evaluate machine learning models. These widgets are essential for building and testing models that make predictions based on the input data. For example, you might use a model to predict whether someone will like a product, or how much a house might cost based on its features.

10. Google Cloud AutoML is a suite of machine learning tools provided by Google Cloud that allows users to build custom machine learning models with minimal coding experience. It was released in January 2018. Google Cloud AutoML makes it easy for users who don't have much knowledge of machine learning (ML) to create powerful and accurate models tailored to their specific business needs, with very little effort.

11. No-Code AI tools provide the following benefits:
    1. **Accessibility:** No-code enables non-technical users to build websites, apps, and apply machine learning to solve business problems, all without needing any programming skills.
    2. **Fast & Time Saving:** Since you don't need to write complex code, you can create and deploy AI solutions much faster, reducing the time it takes to bring your ideas to life.
    3. **Ease of Use:** No-code AI platforms have simple, drag and drop, user-friendly interfaces that allow anyone, even without technical skills, to build and deploy AI models.

12. a. **Internet Search:** One of the most common applications of Data Science is in Internet search engines, such as Google. When you type a question or keyword into the search bar, the search engine employs Data Science algorithms to deliver the most relevant and useful results within seconds.

   b. **Targeted Advertising:** Another major application of Data Science is targeted advertising, which is widely used in digital marketing. You might have noticed that the ads you see online often feel very personal, like they're exactly what you were looking for. This is because digital ads are powered by Data Science algorithms that help companies show you ads that are most relevant to you.

Ai In Life (Page 302)

AI-driven statistical analysis plays a major role in shaping human behavior by identifying patterns and making predictions. While this enhances personalization and efficiency, the question remains: How much control should AI have over our lives?

- **Pros:** AI helps in smarter decision-making, automation, and personalization (e.g., product recommendations, targeted ads, and medical diagnoses).
- **Cons:** Over-reliance on AI may lead to loss of independent thinking, biases in decision-making, and privacy concerns.

Thus, while AI can assist, critical thinking and ethical considerations should always be prioritized to ensure balanced decision-making.

Ai Deep Thinking (Page 302)

AI-powered statistical models drive efficiency and accuracy across industries by analyzing vast amounts of data and identifying patterns.

Real-World Applications of AI-Driven Statistical Models:

Healthcare – AI helps in disease prediction, patient monitoring, and treatment recommendations (e.g., AI detecting early cancer signs).

Finance – AI-driven statistical analysis is used for fraud detection, risk assessment, and investment predictions (e.g., banks identifying fraudulent transactions).

Marketing – AI enhances customer segmentation, personalized recommendations, and trend forecasting (e.g., e-commerce platforms suggesting products based on browsing history).

By integrating AI in statistics, industries achieve greater accuracy, efficiency, and automation, transforming decision-making and operational strategies. However, maintaining ethical standards, transparency, and human oversight is crucial to prevent biases and ensure fairness.

Ai Lab (Page 302)

Do it yourself.

1. Model widgets are used to create, train, and evaluate machine learning models. These widgets are essential for building and testing models that make predictions based on the input data. For example, you might use a model to predict whether someone will like a product, or how much a house might cost based on its features.

   Some of the model widgets are:

   - Tree Widget: It is used to create a decision tree model.
   - Random Forest Widget: It creates an ensemble of decision trees (a forest of trees). Instead of using just one decision tree, it combines multiple trees to make more accurate predictions.

2. While it is a no-code tool, ODM also allows users to write Python scripts for advanced customization. Users can easily integrate their work with Python for further analysis or to extend functionality. This feature makes it flexible and powerful for data scientists who may need to implement more specific or advanced models.

3. A normal distribution is perfectly symmetrical and resembles a bell-shaped curve. The highest point is in the middle, and the tails gradually taper off on both sides. The mean, median, and mode are all the same and are located at the center. Example: Heights of people in a large population often follow a normal distribution. Most people will be of average height, with fewer people being very short or very tall.

4. Automation Bias: No-code tools often rely on automated systems to make decisions or suggestions, and users may become biased toward these automated suggestions. Over-reliance on automation can lead people to trust the AI-generated results too much and overlook other valid alternatives or insights that might be better. This can lead to poor decision-making if not carefully managed.

5.1.   Computer Vision (Theory)

Δi Reboot (Page 305)

1. We see and understand objects by processing visual information through our eyes and brain, recognizing patterns, shapes, colors, and spatial relationships.

2. Computer Vision aims to enable machines to interpret and analyze visual data, allowing them to recognize objects, detect patterns, and make decisions based on images or videos.

Δi GAME 01   (Page 306)

Do it yourself.

Δi Reboot (Page 312)

1. We see and understand objects by processing visual information through our eyes and brain, recognizing patterns, shapes, colors, and spatial relationships.

2. Yes, the quality of the camera matters in Computer Vision systems as higher resolution, better sensors, and improved lighting conditions enhance image accuracy, leading to better object detection and analysis.

🧠 Δi Task (Page 316)

Do it yourself.

🧠 Δi Task (Page 318)

Do it yourself.

▶ **Video Session** (Page 318)

Do it yourself.

Exercise

🔒 Unsolved Questions

SECTION A (Objective Type Questions)

Δi Quiz

A. 1. b   2. c   3. b   4. c   5. c   6. a

B. 1. segmentation   2. optical character recognition (OCR)   3. blue

4. Segmentation   5. security

C. 1. False   2. False   3. True   4. False   5. True

SECTION B (Subjective Type Questions)

A. 1. An RGB image has three color channels: Red, Green, and Blue, which combine to create a full-color image. A grayscale image has only one channel and represents different shades of gray, ranging from black to white.

2. Instance segmentation is a process in computer vision that identifies and separates each object in an image, even if they belong to the same category. It assigns a unique label to every object.

3. A pixel is the smallest unit of a digital image, representing a single point of color.

   • Color Information – Each pixel has a specific color, defined by its RGB (Red, Green, Blue) values.

   • Resolution – The number of pixels in an image determines its clarity and quality.

4. The Google Translate app helps translate text from one language to another. It can also recognize and translate text from images using Optical Character Recognition (OCR).

5. a. Detecting diseases – It helps in identifying diseases like cancer from X-rays, MRIs, and CT scans.

b. Medical image analysis – It assists doctors in analyzing medical images quickly and accurately for better diagnosis.

B. 1. Computer Vision applications for multiple objects involve object detection, segmentation, and tracking. Object detection helps in identifying multiple objects in an image or video by drawing bounding boxes around them. Instance segmentation further classifies each object separately, even if they belong to the same category. Object tracking follows the movement of objects over time in videos. These tasks are used in applications like self-driving cars, crowd monitoring, and security surveillance.

2. Computer Vision is transforming retail stores by enhancing customer experience and operational efficiency. It helps in tracking customer behavior, analyzing foot traffic, and identifying popular products. Automated checkout systems use Computer Vision to recognize products, reducing waiting times. Theft detection and inventory management are also improved as cameras monitor stock levels and suspicious activities. Overall, it helps retailers optimize sales and improve customer satisfaction.

3. For a single object, Computer Vision performs image classification, where the system analyzes an image and assigns it a category. Another task is object localization, which identifies where the object is located within an image. These tasks are useful in applications like facial recognition, barcode scanning, and medical image analysis, where only one object needs to be processed at a time.

4. a. Google Lens – This app allows users to scan and identify objects, translate text, and search for products online just by pointing their phone camera at them. It makes information access faster and more interactive.

   b. Face ID (Apple) – This technology uses facial recognition to unlock smartphones securely and authorize payments. It improves security and convenience by eliminating the need for passwords or PINs.

5. RGB images are digital images that use three primary colors—Red, Green, and Blue—to create a full spectrum of colors. Each pixel in an RGB image is made up of a combination of these three colors, with different intensity levels. These images are widely used in photography, digital screens, and computer graphics because they can represent realistic and vibrant colors.

C. <mark>**Competency-based/Application-based questions.**</mark>

1. b
2. Approach to improve pedestrian detection in low-light conditions:
   - **Enhance dataset quality:** Collect more training data with images of pedestrians in different lighting conditions.
   - **Use advanced preprocessing:** Apply image enhancement techniques like histogram equalization or noise reduction to improve visibility.
   - **Implement better AI models:** Use deep learning models like CNNs with attention mechanisms to better distinguish between pedestrians and cyclists.

- **Integrate additional sensors:** Use infrared or LiDAR sensors alongside cameras to improve object detection in low-light scenarios.
- **Continuous testing and retraining**: Regularly test and update the model to adapt to new conditions.

3. Using Computer Vision for workplace safety in manufacturing:
   - **Hazard detection:** Identify unsafe behaviors, like workers not wearing safety gear.
   - **Accident prevention**: Detect spills, obstacles, or machinery malfunctions in real-time.
   - **Automated monitoring**: Track worker movement and ensure compliance with safety protocols.
   - **Emergency response**: Quickly identify and alert supervisors about potential hazards.

   Assertion and Reasoning questions.

4. a. Both A and R are correct, and R is the correct explanation of A.
5. c. A is correct, but R is incorrect.

Δi In Life (Page 326)

As a student, I feel that AI has made our lives easier, but it also raises serious privacy concerns. Some apps secretly access our cameras or microphones, even when we deny permission, which makes us question how much control we really have over our data. AI collects and analyzes a huge amount of personal information, often benefiting large companies more than users. While AI can be helpful, it should not come at the cost of our privacy. Stronger rules and better security measures are needed to ensure our data stays safe.

Δi Deep Thinking (Page 327)

If the data used to train a Computer Vision (CV) system is flawed, the entire platform will give inaccurate results. Since CV systems rely on millions of images to learn, any mistakes in the dataset—like incorrect labels, poor image quality, or biased samples—can lead to serious errors. For example, a CV-based medical system trained on incorrect data may misdiagnose patients, or a self-driving car might fail to detect obstacles properly. That's why testing and verifying data is extremely important before using it to train AI systems.

Δi Lab (Page 327)

Do it yourself.

Class Activity (Page 328)

Do it yourself.

1. Pixels determine the clarity and sharpness of an image. A 4K resolution has about 3840 x 2160 pixels, while an 8K resolution has 7680 x 4320 pixels. More pixels mean higher image quality, making details appear clearer. 4K and 8K resolutions are commonly used in TVs, cameras, and gaming for better visuals.

2. Computer Vision helps in quality control by detecting defects in products. It automates inspections, reducing human error and increasing efficiency. Robots with CV can sort, assemble, and package items. It also improves workplace safety by monitoring employees and detecting hazards. Additionally, it helps in inventory management by tracking materials in real time.

3. Computer Vision can analyze video interviews to assess candidates' facial expressions and engagement. It enhances security by using facial recognition for office entry and attendance tracking. CV can also monitor employees' workspaces to ensure safety and productivity. Additionally, it can help detect employee stress levels and improve workplace well-being.

4. Computer Vision is used in sports for player tracking, movement analysis, and game strategy improvement. It helps referees make accurate decisions by reviewing replays. CV also enhances fan experience with real-time stats and highlights. In training, athletes use it to analyze their performance and improve techniques.

5.2. Computer Vision (Practical)

Δi Task (Page 334)

Do it yourself.

Δi Reboot (Page 343)

1. Steps for deploying and optimising AI models with no-code tools are as follows:

   i.   **Select the right platform:** Choose a no-code AI platform that aligns with your business needs and objectives. Different platforms offer unique features, so selecting the right one is crucial for success.

   ii. **Prepare your data:** Clean, organise, and preprocess your data. Most no-code platforms provide tools to help you with this step, ensuring your data is ready for training.

   iii. **Build your model:** Use intuitive, drag-and-drop interfaces to create models for tasks like classification, regression, or clustering. The platform will guide you through the process and offer suggestions based on best practices.

   iv. **Train the model:** Once the model is built, use the platform's Auto-ML (Automated Machine Learning) features to optimise the training process. These tools automatically select the best algorithms and parameters for the task.

v. **Fine-tune parameters:** After initial training, adjust model parameters to improve performance. No-code platforms provide automated suggestions or allow manual fine-tuning for further optimisation.

vi. **Evaluate and refine:** Assess the model's performance using built-in metrics. Interpret the results through visualizations, and make necessary adjustments to enhance accuracy and efficiency.

vii. **Deploy the model:** Finally, deploy your model with ease. No-code tools provide deployment options like APIs, web services, or seamless integration with your existing systems, making the deployment process simple.

2. Orange is a powerful, open-source data visualization and analysis tool, widely used in data mining and Machine Learning. It provides a user-friendly, drag-and-drop interface, making it easy for users to analyse data and create workflows without coding. Orange supports tasks like data preprocessing, clustering, classification, regression, and evaluation.

Δi Task (Page 344)

Do it yourself.

Δi Reboot (Page 345)

1. In Computer Vision, an image feature refers to a specific element or piece of information extracted from an image that provides meaningful insights about its content. Features can include edges, corners, start points, endpoints, textures, shapes, or patterns within the image. These features are unique to each image and may vary depending on the image's content, resolution, and context.

2. Combining these features with other attributes, such as texture and intensity variations, can further enhance the accuracy and effectiveness of image processing tasks.

Δi Task (Page 347)

Do it yourself.

Δi Task (Page 350)

Do it yourself.

Δi Task (Page 356)

Based on the given diagram, here is the whole process of how a Convolutional Neural Network (CNN) works:

1. **Convolutional Layer:**
   - The input image is processed using a filter (kernel), which slides over the image to create a **feature map**.
   - This helps in detecting patterns like edges, textures, and other important features.

2. **Rectified Linear Unit (ReLU):**
   - The feature map obtained from the convolutional layer is passed through the **ReLU activation function**.
   - ReLU replaces all negative values with zero, introducing non-linearity and improving the model's ability to learn complex features.
3. **Pooling Layer:**
   - The feature map is then reduced in size using **max pooling**.
   - The pooling operation selects the maximum value from a group of neighboring pixels, which helps in reducing dimensionality while retaining the most important features.
   - This improves computational efficiency and prevents overfitting.
4. **Fully Connected Layer:**
   - The pooled feature maps are **flattened** into a single vector and passed to a fully connected neural network.
   - The network assigns **probabilities** to different categories (e.g., Car, Truck, Bicycle) based on the extracted features.
5. **Final Prediction:**
   - The model provides an output with probability values, indicating the likelihood of the image belonging to a particular class.

▶ **Video Session** (Page 357)

Do it yourself.

Exercise

🔒 Unsolved Questions

SECTION A (Objective Type Questions)

Δ¡ **Q**uiz

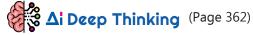|					
1. b	2. c	3. c	4. b	5. b	6. d
7. a	8. b	9. b	10. a	11. c	12. b

SECTION B (Subjective Type Questions)

1. Clean, organise, and preprocess your data. Most no-code platforms provide tools to help you with this step, ensuring your data is ready for training.
2. After initial training, adjust model parameters to improve performance. No-code platforms provide automated suggestions or allow manual fine-tuning for further optimisation.
3. Assess the model's performance using built-in metrics. Interpret the results through visualizations, and make necessary adjustments to enhance accuracy and efficiency.

4. Teachable Machine is a powerful and user-friendly tool developed by Google in 2017. It is designed to make Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL) accessible to everyone, including beginners with no technical background.

5. Images, Audio and poses

6. Orange is a powerful, open-source data visualization and analysis tool, widely used in data mining and Machine Learning. It provides a user-friendly, drag-and-drop interface, making it easy for users to analyse data and create workflows without coding. Orange supports tasks like data preprocessing, clustering, classification, regression, and evaluation.

7. In Computer Vision, an image feature refers to a specific element or piece of information extracted from an image that provides meaningful insights about its content.

8. Corners, like the red patch, are considered good features in an image because they are distinct and can be accurately tracked or located.

9. The Convolutional Layer is the first layer in a Convolutional Neural Network (CNN) and plays a crucial role in processing visual data, such as images. Its main objective is to extract key features from the input image, starting with low-level features like edges, textures, colours, and gradients.

10. This is the last and the final layer of the Convolutional Neural Network. After the features of the input image are extracted by the convolution layers and downsampled by the pooling layers, their output is a 3-dimensional matrix which is flattened into a vector of values.

11. **Max Pooling:** Max Pooling is the most commonly used method that selects the maximum value of the current image view and helps preserve the maximum detected features.

    Average Pooling: Average Pooling finds out the average value of the current image view and thus downsamples the feature map.

12. The convolution operation applies multiple kernels to an image to extract various features from the image. The result of this process is called a feature map (or activation map), which highlights the important features detected by the kernels.

🤖 Ai In Life (Page 362)

Do it yourself.

🧠 Ai Deep Thinking (Page 362)

Do it yourself.

💻 Ai Lab (Page 363)

Do it yourself.

6.1. Natural Language Processing (Theory)

Ai Reboot (Page 366)

1. **Syntax:** This refers to the rules that govern the structure of sentences in a language. It dictates how words and phrases should be arranged to make sense. For example, in English, a typical sentence follows the structure: Subject + Verb + Object (e.g., "John (subject) eats (verb) an apple (object)"). If the syntax is incorrect, the sentence can become confusing or meaningless.

   Semantics is about the meaning of words, phrases, and sentences. It looks at how we understand and interpret these meanings when we use language. For example, the word "bat" can have different meanings depending on the context of a sentence. A bat can refer to a flying mammal (the animal). A bat can also refer to a piece of equipment used in sports like baseball or cricket.

2. The language used by computers to work is **Machine Language** (also known as **Machine Code**). It consists of binary (0s and 1s) and is the lowest-level language that a computer directly understands.

   However, programmers use **high-level languages** like Python, C++, and Java, which are then translated into machine language using compilers or interpreters.

Ai Reboot (Page 366)

1. Plane   2. Sight   3. Break   4. Tear   5. Sail   6. Rein

Ai Task (Page 370)

Do it yourself.

Ai GAME (Page 373)

Do it yourself.

Ai Reboot (Page 381)

Perform the given operations on the following:

Knives	Stemming	Knive
Caring	Stemming	Car
Studies	Lemmatization	Study
Caring	Lemmatization	Care

Ai Task (Page 381)

1. a. Positive   b. Neutral   c. Negative   d. Positive   e. Neutral   f. Neutral

   g. Negative   h. Positive   i. Negative

2. Sentiment analysis can be quantified using **sentiment scores** that range from negative to positive, often represented as:

- **Polarity Score:** A numerical value (e.g., -1 for negative, 0 for neutral, +1 for positive).
- **Categorical Labels:** Classification into categories like Positive, Neutral, and Negative.
- **Emotion Detection:** Identifying emotions like joy, anger, sadness, etc.

Real-World Applications:

- **Customer Feedback Analysis:** Businesses analyze reviews to improve products.
- **Social Media Monitoring:** Detect public opinion on trends and events.
- **Brand Reputation Management:** Companies track sentiment about their brand.
- **Stock Market Predictions:** Analyzing news and social media sentiment to predict stock trends.
- **Healthcare & Mental Health:** Detecting emotions in patient feedback and mental health analysis.

▶ **Video Session** (Page 383)

Do it yourself.

Exercise

🔒 Unsolved Questions

SECTION A (Objective Type Questions)

Δi Quiz

A. 1. c   2. b   3. c   4. c   5. a   6. b
   7. c   8. c

B. 1. conversation, robot   2. NLTK   3. Gensim   4. token   5. corpus
   6. virtual assistants   7. Rule-based, AI-based   8. extractive summarization

C. 1. True   2. True   3. True   4. False   5. False   6. False
   7. True   8. True

SECTION B (Subjective Type Questions)

A. 1. Natural Language Processing (NLP) is a subfield of Artificial Intelligence that focuses on enabling computers, through specialised programs, to perform tasks such as speech recognition, translation, and the analysis and extraction of large amounts of natural language data.

2. It refers to the process of converting text or speech from one language to another using NLP. This technology aids in learning new languages and facilitates cross-cultural understanding.

3. A Script-Bot is a simple chatbot with limited functionalities. These chatbots follow predefined rules and execute specific tasks based on a scripted flow. Since they operate within a structured framework, they are easy to develop and require little to no programming knowledge.

4. Automatic Text Summarisation is the process of creating the most meaningful and relevant summary of voluminous texts from multiple sources.

5. There are many techniques used in NLP for extracting information but the three given below are most commonly used:

   i.   Bag of Words

   ii. Term Frequency and Inverse Document Frequency (TFIDF)

   iii. Natural Language Toolkit (NLTK)

B. Long answer type questions.

1.

Human Language	Computer Language
Evolved naturally for communication between people.	Designed to communicate with computers and control their behavior.
Consists of syntax (structure), semantics (meaning), and lexicon (word meanings).	Follows precise syntax and semantics, ensuring that commands are understood by machines.
Subject to change over time and has redundancy.	Evolves more slowly, and errors occur when syntax or semantics are not strictly followed.
Context-dependent and allows ambiguity and interpretation based on the situation.	Aimed at solving computational tasks rather than communication between people.

2. **Automatic Text Summarisation:** Automatically generates the most relevant and concise summary of large texts, widely used by platforms like Google News and Inshorts.

   Language Translation: Converts text or speech from one language to another, using systems like Google Translate for real-time translation.

3. **Sentiment Analysis:** It involves analyzing text data to determine the sentiment expressed, such as positive, negative, or neutral. Businesses use sentiment analysis to understand customer feedback, improve products, and adjust strategies.

   Emotion Analysis: This goes beyond sentiment and involves identifying specific emotions like happiness, anger, sadness, or surprise in text data. This analysis helps businesses and social media platforms assess the emotional tone of the content.

4. A chatbot is an AI-powered program designed to simulate conversation with human users via text or voice. It is a conversational agent that automates tasks like answering queries, providing customer support, or assisting with routine activities. Chatbots can be integrated

into websites, mobile apps, and messaging platforms like WhatsApp, Facebook Messenger, and more.

5. **Stemming:** A faster process that reduces words to their root form by removing prefixes or suffixes, but the resulting word may not always be meaningful (e.g., "jumping" → "jump").

   Lemmatization: A more precise process that reduces words to their dictionary form or lemma, ensuring that the output is always a valid word. It requires context and is computationally more intensive (e.g., "better" → "good").

6. **Document Classification:** TFIDF helps categorize documents based on the content, such as classifying news articles by topics like sports, politics, etc.

   Information Retrieval Systems: TFIDF is used to retrieve the most relevant information from a corpus based on the frequency and importance of search keywords.

C.   **Competency-based/Application-based questions.**

1.

S.No	Word	Affixes	Lemma
1	Tries	-es	Try
2	Learning	-ing	Learn

2. **Step 1** Compute Term Frequency (TF)

   TF is calculated as:

   $$TF = \frac{\text{Number of times the term appears in a document}}{\text{Total number of terms in the document}}$$

   Corpus:
   - Document 1: *Jack and Jill went uphill* → (5 words)
   - Document 2: *Jack fell down* → (3 words)
   - Document 3: *Jill broke down* → (3 words)

Term	Doc 1 (TF)	Doc 2 (TF)	Doc 3 (TF)
Jack	1/5 = 0.2	1/3 = 0.33	0
Jill	1/5 = 0.2	0	1/3 = 0.33
And	1/5 = 0.2	0	0
Went	1/5 = 0.2	0	0
Uphill	1/5 = 0.2	0	0
Fell	0	1/3 = 0.33	0
Down	0	1/3 = 0.33	1/3 = 0.33
Broke	0	0	1/3 = 0.33

Step 2 Compute Inverse Document Frequency (IDF)

IDF is calculated as:

$$IDF = \log\left(\frac{\text{Total number of documents}}{\text{Number of documents containing the term}}\right)$$

Term	Document Frequency (DF)	IDF Calculation	IDF Value
Jack	2	log(3/2)	0.18
Jill	2	log(3/2)	0.18
And	1	log(3/1)	0.48
Went	1	log(3/1)	0.48
Uphill	1	log(3/1)	0.48
Fell	1	log(3/1)	0.48
Down	2	log(3/2)	0.18
Broke	1	log(3/1)	0.48

Step 3 Compute TF – IDF

TF – IDF = TF × IDF

Term	Doc 1 (TF-IDF)	Doc 2 (TF-IDF)	Doc 3 (TF-IDF)
Jack	0.2 × 0.18 = 0.036	0.33 × 0.18 = 0.059	0
Jill	0.2 × 0.18 = 0.036	0	0.33 × 0.18 = 0.059
And	0.2 × 0.48 = 0.096	0	0
Went	0.2 × 0.48 = 0.096	0	0
Uphill	0.2 × 0.48 = 0.096	0	0
Fell	0	0.33 × 0.48 = 0.158	0
Down	0	0.33 × 0.18 = 0.059	0.33 × 0.18 = 0.059
Broke	0	0	0.33 × 0.48 = 0.158

Assertion and Reasoning Questions

3. a. Both A and R are correct and R is the correct explanation of A.

4. a. Both A and R are correct and R is the correct explanation of A.

Ai In Life (Page 395)

Chatbots have made life easier in many ways. They provide quick answers to our questions, help businesses serve customers 24/7, and make learning fun and interactive. They save time,

reduce workload, and even assist in healthcare and banking. With chatbots, we can get instant help anytime, making things more convenient for everyone.

Ai Deep Thinking (Page 395)

This happens because many apps and websites track our online activity. Even if we don't search for something, our devices can collect data from what we talk about, type, or like on social media. Companies use this data to show us ads that match our interests. Sometimes, it feels like they are listening, but they are actually using smart technology to guess what we might like based on our behavior.

Ai Lab (Page 395)

Do it yourself.

Ai Ready (Page 396) 6

1. The text processing libraries do text processing through tokenization, parsing, classification, stemming, tagging and semantic reasoning.

2. In the real world, sentiment analysis plays a crucial role in assessing customer satisfaction, measuring brand or product popularity, and tracking trends such as fashion or market shifts.

3. Sentence segmentation is a process of detecting sentence boundaries, which divides the corpus into sentences or documents. Most of the human languages used across the world have punctuation marks to mark the boundaries of the sentences, this feature helps reduce the complexity of the big data set into a low and less complicated level of data processing. Each sentence after this will be treated as a separate document.

4. After the process of text normalisation, the corpus is converted into a normalised corpus, which is a collection of meaningful words with no sequence. Bag of Words is a simple and important technique used in Natural Language Processing for extracting features from the textual data. It converts text sentences into numeric vectors by returning the unique words along with its number of occurrences.

6.2. Natural Language Processing (Practical)

▶ **Video Session** (Page 399)

Do it yourself.

Ai Reboot (Page 399)

1. NLP with the Orange Data Mining Tool allows users to perform text preprocessing, topic modelling, and sentiment analysis through an easy-to-use visual workflow interface. It simplifies natural language processing tasks without requiring extensive programming knowledge.

2. It uses English and German. It is based on vector space models, which are computational methods representing words or phrases in multi-dimensional space, it computes the valence (emotional value) of text.

Δi Task (Page 408)

Do it yourself.

Exercise

🔒 Unsolved Questions

SECTION A (Objective Type Questions)

Δi Quiz

1. a   2. b   3. b   4. a   5. b   6. c
7. c   8. c

SECTION B (Subjective Type Questions)

1. MeaningCloud is a No-Code Natural Language Processing (NLP) tool that provides text analytics services. It allows users to extract meaningful insights from text data without requiring programming knowledge. It offers APIs that can be integrated into applications, but it also provides a no-code platform where users can upload text and get insights without programming.

2. No-code NLP tools enable users to perform Natural Language Processing tasks without programming knowledge. Different platforms offer intuitive interfaces for text mining, sentiment detection, and more. These tools are ideal for businesses and individuals seeking quick and scalable NLP solutions.

3. Sentiment analysis is a technique within Natural Language Processing (NLP) that helps determine the emotional tone behind a piece of text. The goal is to analyse whether the text expresses a positive, negative, or neutral sentiment. This can be applied to various forms of communication, such as customer reviews, social media posts, and feedback messages, to gain insights into how people feel about a specific topic, product, service, or brand.

4. (i) Customer Service Customer sentiment analysis helps in the automatic detection of emotions when customers interact with products, services, or brands.

   (ii) Voice of the Customer Voice of the customer analysis helps to analyse customer feedback and gain actionable insights from it. It measures the gap between what customers expect and what they actually experience when they use the products or services.

5. Follow the following steps in the process of data acquisition:

   Step 1   Open the Orange Data Mining application and click on the New option. It opens the new canvas.

Step	2	Click on File widget to place it on the Canvas.
Step	3	Click on Corpus to place it on the Canvas and load the dataset from the computer in the xls format to the corpus.
Step	4	Connect the File to Corpus by dragging the output from file to the input of Corpus.
Step	5	Insert the Data Table just next to Corpus and connect the Corpus to Data Table by dragging the output from Corpus to the input of Data Table.
Step	6	Double-click on Data Table widget to see how data appears now.
Step	7	Insert the Corpus Viewer just next to Corpus and connect the Corpus to Corpus Viewer by dragging the output from Corpus to the input of Corpus Viewer.
Step	8	Double-click on the Corpus Viewer widget to see the data.

6. Follow the following steps in the process of data exploration:

Step	1	Double-click on Data Table widget to see missing data.
Step	2	Insert the Preprocess Text and connect Corpus to Preprocess Text by dragging the output from Corpus to the input of Preprocess Text.
Step	3	Double-click on PreProcess Text to open the Properties Window.

Δi In Life (Page 412)

Sentiments play a key role in consumer buying behavior as positive reviews and emotions can boost sales, while negative sentiments can deter buyers. However, sentiment ratings alone don't determine a product's success. Other factors like price, quality, brand reputation, personal preferences, social influence, and marketing strategies also impact consumer decisions.

Δi Deep Thinking (Page 412)

Using NLP sentiment analysis in marketing is ethical as long as it helps businesses understand customer needs and improve services. However, manipulating sentiments through fake reviews, misleading ads, or emotional exploitation can be unethical. Risks include loss of trust, misinformation, privacy concerns, and potential legal issues if consumers are deceived. Transparency and responsible use are key.

Δi Lab (Page 412)

Do it yourself.

7. Advance Python (Practical)

Δi Task (Page 435)

1. 8   2. 45.2   3. 44   4. 60   5. 65

Δi Reboot (Page 443)

- Conditional statements are used for selecting the block of statements to be executed based on the condition.
- There are two types of looping statements in Python: a) for loop b) while loop

Δi Task (Page 456)

a. This retrieves the row with the index value 22 from the DataFrame f2. If the index 22 exists, it will return that row. If not, it will raise a KeyError.

b. This modifies all the elements in the entire DataFrame f2, replacing every value with 0.

c. This adds a new row to the DataFrame with the index 33 if it doesn't already exist. All the values in this row will be set to 0. If the index 33 already exists, its row will be updated with 0.

Δi Task (Page 477)

Do it yourself.

Exercise

🔒 Unsolved Questions

SECTION A (Objective Type Questions)

Δi Quiz

A.	1. c	2. c	3. b	4. b	5. a	6. c
	7. b	8. b	9. c	10. a	11. c	12. d

B. 1. sep   2. Comparison (==)   3. else   4. input()

5. Variable   6. Assignment   7. / (division), // (floor division)

8. Monty Python   9. scipy.linalg   10. pip install scipy   11. plt.bar()

12. plt.ylim()   13. values   14. NaN (Not a Number)   15. matrix

C.	1. True	2. False	3. True	4. True	5. False	6. True
	7. True	8. True	9. False	10. True	11. False	12. True
	13. True	14. True				

SECTION B (Subjective Type Questions)

A. 1. a. "abc" = name → Incorrect because variable names should be on the left side. Correct: name = "abc"

b. print("hello class) → SyntaxError: Closing quotation mark is missing. Correct: print("hello class")

c. n = input(enter a number) → NameError: String should be enclosed in quotes. Correct: n = input("Enter a number")

d. n1 = 10, n2 = 20 → SyntaxError: Variables should be assigned separately. Correct: n1 = 10; n2 = 20

e. 20 / 10 = a → SyntaxError: Cannot assign a value to an expression. Correct: a = 20 / 10

f. a + b = c → SyntaxError: Cannot assign to an expression. Correct: c = a + b

g. num = int(input(enter your name) → SyntaxError: String should be enclosed in quotes. Correct: num = int(input("Enter your name"))

2. a. print(12 < 9 and 10 >= 20) → False

   b. print(int(False) + 10) → 10

   c. print(12 / 2 + 2) → 8.0

   d. print('5' + '10') → '510'

   e. print(12 + 3 * ((10 * 2) - 8) / 5) → 18.6

   f. print(-12 // 3) → -4

3. a. else → Invalid, because else is a reserved keyword in Python.

   b. My house → Invalid, because identifiers cannot have spaces.

   c. #number → Invalid, because # is used for comments in Python.

   d. Class1 → Valid, as it follows identifier rules.

   e. firstname → Valid, as it follows identifier rules.

   f. Full Name → Invalid, because identifiers cannot have spaces.

   g. Rollno → Valid, as it follows identifier rules.

4. The scipy.optimize module is used for optimization and root-finding problems. It provides functions to minimize or maximize objective functions. One function it provides is minimize(), which is used to find the minimum of a function.

5. The plt.xticks() function in Matplotlib is used to customize the x-axis ticks. It allows setting the positions and labels of the ticks on the x-axis, improving readability and customization of plots.

6. • **Memory Efficiency:** NumPy arrays are more memory-efficient than Python lists because they store data in a contiguous block of memory, allowing faster access and processing. Python lists, on the other hand, store references to objects, making them less efficient.

   • **Mathematical Operations:** NumPy arrays support vectorized operations, meaning mathematical operations can be performed on entire arrays at once, making computations faster. In contrast, Python lists require explicit loops for element-wise operations, making them slower.

Ai In Life (Page 485)

Do it yourself.

Ai Deep Thinking (Page 485)

Do it yourself.

Ai Lab (Page 485)

a.
```python
import math
radius = float(input("Enter the radius of the circle: "))
area = math.pi * radius ** 2
circumference = 2 * math.pi * radius
print("Area of the circle:", area)
print("Circumference of the circle:", circumference)
```

b.
```python
num1 = float(input("Enter first number: "))
num2 = float(input("Enter second number: "))
num3 = float(input("Enter third number: "))
average = (num1 + num2 + num3) / 3
print("Average of three numbers:", average)
```

c.
```python
num1 = float(input("Enter first number: "))
num2 = float(input("Enter second number: "))
num3 = float(input("Enter third number: "))
highest = max(num1, num2, num3)
print("The highest number is:", highest)
```

d.
```python
for num in range(22, 51, 2):
    print(num, end=" ")
```

e.
```python
print("HELLO"[::-1])
```

f.
```python
age = int(input("Enter your age: "))
if age >= 18:
    print("You are eligible for driving.")
else:
    print("You are not eligible for driving.")
```

g.
```python
total = 0
for i in range(5):
```

```
        num = float(input(f"Enter number {i+1}: "))
        total += num
    print("Sum of the numbers:", total)
h.  name = input("Enter your name: ")
    times = int(input("Enter a number: "))
    for _ in range(times):
        print(name)
```

Δi Ready (Page 486) **7**

1. Yes, Python is great for machine learning and AI because it has simple syntax, powerful libraries like TensorFlow, PyTorch, and Scikit-learn, and a large community for support. It allows easy data handling, automation, and quick prototyping, making it a top choice for AI development.

2. Python helps in AI by providing libraries for data analysis, machine learning, and deep learning. It supports automation, natural language processing, and image recognition. With frameworks like Keras and OpenCV, it simplifies complex AI tasks.

3. Python is the best language for AI because of its simplicity, vast libraries, and flexibility. Other languages like Java, C++, and R are also used, but Python remains the most popular due to its ease of use and strong AI ecosystem.

4. Yes, AI requires coding to create and train models, process data, and develop AI applications. However, some AI tools offer no-code or low-code options, making AI accessible to beginners.

5. Python is a programming language used to build AI applications. AI (Artificial Intelligence) is a field that enables machines to think and learn. Machine learning is a part of AI that helps machines learn from data without being explicitly programmed.