Class 10

Answer Key

Part A-Employability Skills

Artificial Intelligence Play (Ver. 1.0)

1. Communication Skills-II

Reboot (Page 21)

1. The main elements in this communication cycle are:
   - 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. The examples of all forms of communication are:
   - 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.

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

Quiz

A.

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

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. 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.

 **Lab Activity** (Page 33)

Do it yourself.

2. Self-Management Skills-II

 **Reboot** (Page 36)

1. Common signs of stress are:
    - 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 38)

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.

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

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 of stress in our body are:
   - Lack of sleep
   - Restlessness and anxiety

- Frequent headaches
- Frequent mood swings
- Loss of appetite

5. The advantages of self-regulation are:
   - 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. 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.

Lab Activity (Page 47)

Do it yourself.

3. Information & Communication Technology Skills-II

Reboot (Page 58)

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 are:

   Step 1 Press Windows + R to open the Run dialog box.

   Step 2 Type %temp% and press Enter.

   Step 3 A folder with temporary files will open.

   Step 4 Press Ctrl + A to select all files.

   Step 5 Press Delete on your keyboard and confirm.

   Step 6 Empty the Recycle Bin to remove them completely.

5. Different ways to keep the hardware components clean are:

   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. **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 69)

Do it yourself.

4. Entrepreneurial Skills-II

Reboot (Page 77)

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.

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

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. Positive impacts of entrepreneurship on society are:
   - Creates jobs for people
   - Helps the economy grow
   - Brings new and useful products or services
4. The important myths of an entrepreneurship are:
   - 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. **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.

Lab Activity (Page 80)

Do it yourself.

5. Green Skills-II

Reboot (Page 87)

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.

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

SECTION B (Subjective Type Questions)

A. 1. The five SDGs are as follows:
   (i) No Poverty
   (ii) Zero Hunger
   (iii) Quality Education
   (iv) Climate Action
   (v) Clean Water and Sanitation
2. Challenges to fulfil SDGs are:
   (i) Lack of funding and financial resources
   (ii) Climate change and environmental degradation
3. Importance of sustainable development are:
   (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. 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.
   - Organise 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:
   - Step 1 Collect fruit and vegetable peels, tea leaves, and other organic waste.
   - Step 2 Put them in a compost bin or a pit in the garden.
   - Step 3 Add dry leaves or newspaper to balance moisture and airflow.
   - Step 4 Mix the compost occasionally and keep it slightly moist.
   - Step 5 After 4-6 weeks, the compost will turn into nutrient-rich manure, which can be used for plants.

Lab Activity (Page 90)

Do it yourself.

Class 10

Answer Key

Part B-Subject Specific Skills | Artificial Intelligence Play (Ver. 1.0)

1. Revisiting AI Project Cycle & Ethical Frameworks for AI

Ai Reboot (Page 94)

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 96)

Do it yourself.

Ai GAME 01 (Page 97)

Do it yourself.

Ai GAME 02 (Page 98)

Do it yourself.

AI GAME 03 (Page 99)

Do it yourself.

AI GAME 04 (Page 101)

Do it yourself.

AI Task (Page 102)

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 103)

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:
   - 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.
   - 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.
8. (a) Both A and R are true and R is the correct explanation of A.

Ai Lab (Page 112)

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. Advanced Concepts of Modeling in AI

Ai Reboot (Page 117)

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.

Ai Task (Page 123)

Case 1: Supervised Learning

Case 2: Unsupervised Learning

Case 3: Unsupervised Learning

Case 4: Supervised Learning

Ai Reboot (Page 128)

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

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

AI 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. Competency-based/Application-based questions:

1. 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. 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.

Assertion and Reasoning Questions:

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

Ai Lab (Page 140)

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.

3. Evaluating Models

Ai Reboot (Page 144)

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 145)

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 153)

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.

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:

   a. **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.

   b. **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.

   c. **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

   a. **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:

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

$$= 910 / 1000$$

$$= 0.91 (91\%)$$

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

Formula:

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

Calculation:

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

$$= 90 / 130$$

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

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

Formula:

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

Calculation:

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

$$= 90 / 140$$

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

d. **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.

AI Lab (Page 164)

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:**
   $$= \frac{TP + TN}{TP + FP + TN + FN}$$
   $$= \frac{50 + 70}{15 + 5 + 70 + 2}$$
   $$= \frac{85}{92}$$
   $$\approx 0.923 \text{ (92.3\%)}$$

   - **Precision:**
   $$= \frac{TP}{TP + FP}$$
   $$= \frac{15}{15 + 5}$$
   $$= \frac{15}{20}$$
   $$= 0.75 \text{ (75\%)}$$

   - **Recall (Sensitivity):**
   $$= \frac{TP}{TP + FN}$$

$$= \frac{15}{15 + 2}$$
$$= \frac{15}{17}$$
$$\approx 0.882 \text{ (88.2\%)}$$

- **F1 Score:**
$$= 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$
$$= 2 \times \frac{0.75 \times 0.882}{0.75 + 0.882}$$
$$\approx 0.811 \text{ (81.1\%)}$$

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:**
$$= \frac{TP + TN}{TP + TN + FP + FN}$$
$$= \frac{100 + 320}{100 + 320 + 45 + 65}$$
$$= \frac{420}{530}$$
$$\approx \mathbf{79.2\%}$$

- **Precision:**
$$= \frac{TP}{TP + FP}$$
$$= \frac{100}{100 + 45}$$
$$= \frac{100}{145}$$
$$\approx \mathbf{68.9\%}$$

- **Recall:**
$$= \frac{TP}{TP + FN}$$
$$= \frac{100}{100 + 65}$$
$$= \frac{100}{165}$$
$$\approx \mathbf{60.6\%}$$

- **F1 Score:**
$$= 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$
$$= 2 \times \frac{0.689 \times 0.606}{0.689 + 0.606}$$

$$= 2 \times \frac{0.4177}{1.295}$$
$$\approx \mathbf{64.5\%}$$

4. Statistical Data (Practical)

Ai Reboot (Page 173)

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 173)

Do it yourself.

Ai Reboot (Page 179)

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

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:
    a. **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.
    b. **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.
    c. **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 Lab** (Page 192)

Do it yourself.

5. Computer Vision

 **Ai Reboot** (Page 194)

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.

Ai GAME 01 (Page 194)

Do it yourself.

 **Ai Reboot** (Page 198)

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.

Ai Task (Page 202)

Do it yourself.

Ai Task (Page 203)

Do it yourself.

Ai Task (Page 206)

Do it yourself.

Ai Reboot (Page 210)

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.

Ai Task (Page 211)

Do it yourself.

Ai Reboot (Page 212)

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.

Ai Task (Page 214)

Do it yourself.

Ai Task (Page 216)

Do it yourself.

Ai Task (Page 221)

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.

Exercise (Theory)

Unsolved Questions

SECTION A (Objective Type Questions)

AI 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. Competency-based/Application-based questions:

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.

Exercise (Practical)

Unsolved Questions

SECTION A (Objective Type Questions)

AI Quiz

1. b 2. c 3. c 4. a 5. b
6. c 7. 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. 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.
3. Fully Connected Layers in CNNs map extracted features to predictions, enabling classification or decision-making.
4. 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.
5. ReLU introduces non-linearity to a CNN by converting negative values to zero, allowing the network to model complex patterns effectively.

AI Lab (Page 231)

1. Discuss the challenges of using Computer Vision in society.
   - **Privacy Concerns:** Facial recognition can lead to surveillance issues.

- **Bias & Fairness:** AI models may misclassify people due to biased datasets.
- **High Computational Cost:** Requires powerful hardware and large datasets.
- **Security Risks:** Can be fooled by adversarial attacks (e.g., tricking self-driving cars).
- **Ethical Issues:** Use in law enforcement and decision-making raises moral concerns.

2. You are the discipline in-charge of the school. During the festival season, there was a cracker burst in the boy's washroom. Discuss the steps taken to identify the student who was responsible for the same. Also mention how Computer Vision helped.

   Steps Taken:

   - Review CCTV footage near the washroom.
   - Identify students entering/exiting around the incident time.
   - Interview witnesses and check student schedules.
   - Cross-verify with AI-based face recognition for accuracy.

   How Computer Vision Helped:

   - Analyzed CCTV footage to track movement.
   - Used facial recognition to match students with the database.
   - Detected anomalies (e.g., suspicious activity, object detection for crackers).

3. Give the list of software/ applications that use CV. You can take the help from your teacher or from the internet.
   - **Google Lens** – Identifies objects and text from images.
   - **Tesla Autopilot** – Assists in self-driving vehicles.
   - **Face ID (Apple)** – Unlocks phones using facial recognition.
   - **Amazon Go** – AI-powered cashier-less stores.
   - **Adobe Sensei** – Enhances images using AI-powered editing.
   - **DeepMind AlphaFold** – Predicts protein structures using image analysis.
4. Do it yourself.

Ai Lab (Page 232)

Do it yourself.

6. Natural Language Processing

Ai Reboot (Page 233)

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: 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 Task (Page 236)

Do it yourself.

Ai Reboot (Page 250)

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.

Exercise (Theory)

Unsolved Questions

SECTION A (Objective Type Questions)

Ai 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. 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:

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

   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

Term	Doc 1 (TF)	Doc 2 (TF)	Doc 3 (TF)
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.

Exercise (Practical)

Unsolved Questions

SECTION A (Objective Type Questions)

AI Quiz

1. b 2. b 3. a 4. b 5. 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. 1. Customer Service Customer sentiment analysis helps in the automatic detection of emotions when customers interact with products, services, or brands.
   2. 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 exploration:

   All the steps of Data Acquisition.

   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.

Ai Lab (Page 262)

Do it yourself.

Ai Lab (Page 262)

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.

7. Advance Python (Practical)

Ai Reboot (Page 285)

- 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

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

Ai Quiz

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

B. 1. sep 2. else 3. / (division), // (floor division) 4. Monty Python
5. pip install scipy 6. plt.bar() 7. plt.ylim() 8. matrix

SECTION B (Subjective Type Questions)

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. 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.

3. 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.

4. 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.

5. • **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 Lab (Page 302)

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

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

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

g.
```
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)
```