Class 9

Answer Key

Artificial Intelligence Ver. 1.0

Part A: Employability Skills

1. Communication Skills-I

Exercise

SECTION A (Objective Type Questions)

Quiz

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

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

C. 1. Interrogation 2. Assertive 3. Assertive
4. Exclamatory 5. Imperative

D. 1. **She** (pronoun) **went** (verb) **to** (preposition) the **market** (noun) to **buy** (verb) **fruits** (noun).
2. **I** (pronoun) **am** (verb) **scared** (adjective) **of** (preposition) **thunder** (noun) and **lightning** (noun).
3. **Ankit** (noun), what's **your** (pronoun) **opinion** (noun) **about** (preposition) **this** (pronoun)?
4. **Teacher** (noun) **Sunita** (noun) **teaches** (verb) **Physics** (noun) and **Mathematics** (noun).
5. **Priya** (noun) and **her** (pronoun) **friends** (noun) **are going** (verb) **on** (preposition) a **picnic** (noun).

E. 1. **IT as part of the education system**

Information Technology (IT) has revolutionized the education system by making learning more accessible and interactive. With the help of digital tools like online classes, e-books, and AI-powered learning platforms, students can study anytime and anywhere. IT enables personalized learning experiences and enhances engagement through multimedia content. It also plays a vital role in research, communication, and data analysis, preparing students for the digital age.

2. **Gratitude**

Gratitude is the act of appreciating the good things in life. It helps us focus on positivity and strengthens our relationships. Expressing gratitude towards parents, teachers, and friends makes us feel happier and more content. Small acts like saying "thank you" or writing a

gratitude journal can make a big difference in our mindset. Practicing gratitude regularly leads to a more fulfilling and peaceful life.

F. 1. an 2. The 3. a 4. an, the
5. The 6. a

G. 1. Active: She sings a beautiful song.
Passive: A beautiful song is sung by her.
2. Active: The teacher explains the lesson.
Passive: The lesson is explained by the teacher.
3. Active: John reads a book every night.
Passive: A book is read by John every night.
4. Active: They built a new house.
Passive: A new house was built by them.
5. Active: The dog chased the cat.
Passive: The cat was chased by the dog.

SECTION B (Subjective Type Questions)

A. 1. Encoding in communication is the process of converting thoughts or ideas into symbols, words, or gestures for transmission.

2. If the surrounding area of the communication is imbalanced, then, the impact of the communication will not be much. Fear, anxiety, aggression, etc. strongly affect the communication skills.

3. The content of the message should stick to the topic and should flow in a sequence that makes sense.

4. Oral communication is communication using spoken words in an interactive way to share ideas or information. It can be a direct face-to-face conversation or a telephonic conversation.

5. Interrogative Sentences

6. A' and 'An' are indefinite articles which are used before a noun that are not specific or known before. "A" is used before a word beginning with a consonant (alphabets other than vowels) sound. For example: * A book (it can be any book) * A game (it can be any game). "An" is used before a word that begins with a vowel(a, e, i, o, u) sound. For example, an umbrella, an hour, an ice cream cone, etc.

B. **Competency-based/Application-based questions:**

1. Grading Criteria for a Paragraph:
   - **Clarity & Relevance:** The paragraph should clearly convey the main idea and stay on topic.
   - **Structure:** It should have a proper introduction, body, and conclusion.
   - **Grammar & Spelling:** Correct grammar, punctuation, and spelling should be used.

- **Coherence & Flow:** Ideas should be logically connected with appropriate transitions.
- **Content & Accuracy:** The information should be relevant, accurate, and well-supported with facts or examples.

2. Correct Sentence: I bought **a** smartphone.

   Rules for Using Articles:

   - **'A'** is used before words that begin with a consonant sound (e.g., a book, a university).
   - **'An'** is used before words that begin with a vowel sound (e.g., an apple, an hour).
   - **'The'** is used for specific nouns (e.g., the sun, the Eiffel Tower).
   - The choice of article depends on **pronunciation, not just spelling**. "Smartphone" starts with a consonant sound (/s/), so "a" is correct.


Lab Activity (Page 29)

Do it yourself.

2. Self-Management Skills-I

Exercise

SECTION A (Objective Type Questions)

Quiz

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

B. 1. Social 2. Problem-solving 3. Self-esteem 4. attire

Section B (Subjective Type Questions)

A. 1. It is the ability to manage your impulse, emotions and behaviour. Know yourself so you can manage your emotions and impulses. It acts as a force to have a more successful and satisfying life. For example, the Indian system of fasting is an excellent example of self-control. Fasting restricts a person from eating specific food.

2. Itis the ability to plan and organise a given task in an effective manner.Good organisational abilities will prevent difficulty in your work and disorder in your daily life. For example, A student needs to have necessary material for the assigned activity, stay in their seat, and finish required work before going to the next assignment.

3. Low self-confidence can lead to hesitation, missed opportunities, and vulnerability to external influences, often resulting in undesirable situations.

4. Apart from academics, the only source of knowledge is experience.

5. Positive Affirmations for Success
   - I am capable of achieving my goals with dedication and persistence.
   - Every challenge I face is an opportunity to grow stronger.
   - I trust my skills and creativity to make a meaningful impact.
   - Distractions and doubts do not define me—I stay focused and resilient.
   - I am building a future where innovation, leadership, and purpose align.
   - My efforts today shape the success I will achieve tomorrow.

B. 1. Organisational Skills 2. Self-Control 3. Self-Motivation
4. Self-Commitment 5. self-Confidence

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

1. Ankit, try using a daily planner or to-do list to organize your tasks. Setting clear goals, breaking them into smaller steps, and following a schedule will help you stay on track. Also, set deadlines for yourself—it builds self-discipline and ensures timely work.
2. I judge myself based on my own views, not others' expectations. Everyone has different strengths and goals, so comparing with others is not helpful. I focus on improving myself, setting my own standards, and growing at my own pace.

Lab Activity (Page 40)

Do it yourself.

3. ICT Skills-I

Exercise

SECTION A (Objective Type Questions)

Quiz

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

B. 1. ICT 2. E-Banking 3. Communication Channels 4. YouTube 5. Protocols
6. Homepage 7. URL 8. BCC

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

D. Plotter – Output Device
Microphone – Input Device

Flash Drive – Storage Device

Speaker – Output Device

Scanner – Input Device

Printer – Output Device

Hard Disk – Storage Device

Bar Code Reader – Input Device

Light Pen – Input Device

Projector – Output Device

E. 1. System Software vs. Application Software:

- **System Software:** Controls and manages hardware operations (e.g., Operating System).
- **Application Software:** Designed for specific tasks (e.g., MS Word, Photoshop).

2. Cold Booting vs. Warm Booting:

- **Cold Booting:** Starting the computer from a powered-off state.
- **Warm Booting:** Restarting the computer without turning off the power.

3. Serial Port vs. Parallel Port:

- **Serial Port:** Transfers data one bit at a time (e.g., COM port).
- **Parallel Port:** Transfers multiple bits simultaneously (e.g., Printer port).

F. 1. SMTP (Simple Mail Transfer Protocol)

2. TCP/IP (Transmission Control Protocol / Internet Protocol)
3. FTP (File Transfer Protocol)
4. HTTPS (HyperText Transfer Protocol Secure)

Section B (Subjective Type Questions)

A. 1. Blu-ray disc is of the same dimension as that of CD or DVD and uses the same optical rays technology for recording and playing back high-definition (HD) video and for storing large amounts of data. It has a capacity of up to 25 GB.

2. Software that is required to control the functions of a computer is called system software. It refers to a program that works as a manager of the computer.
3. A light pen is a pointing device shaped like a pen and is connected to a VDU. The tip of the light pen contains a light-sensitive element which, when placed against the screen, detects the light from the screen enabling the computer to identify the location of the pen on the screen. We generally use it to make a selection or draw anything on a screen.
4. A laser printer works just like a photocopy machine that prints the output at high-speed and good quality. It creates images using a laser beam and powdered ink called toner. It is more expensive than inkjet printers and can be used for home or business purposes.

5. Motherboard or the main board consists of a board containing electric circuit that connects all the important components of the computer. If the CPU is the brain of the computer, then, the motherboard is the central nervous system making it the backbone or spine of a computer system. It consists of:
   - Ports to connect different input and output devices.
   - Memory slots that contain the system's main memory.
   - ROM-BIOS chip that acts as an interface between the operating system and the hardware of a computer.
   - System Clock that synchronises all the components of the motherboard.
   - Power Connector that gives power supply to all the essential components on the motherboard.
6. (a) ALU: Arithmetic Logic Unit
   (b) CU: Control Unit
   (c) CPU: Central Processing Unit
7. CU stands for Control Unit. It controls the flow of information in the system. The control unit is responsible for the flow of data from input devices to the processing unit and then to the output devices. It works like a traffic policeman who controls the traffic on the road.
8. - In postal mail, if you have to send the same letter to multiple recipients, then it is an expensive process. Through email we can send the same mail to multiple recipients by just writing the email address in cc or bcc with no added cost.
   - In postal mail, the recipient can receive mail only at the marked geographical location using street number, locality, city, pincode, etc. In email, it is a logical address that can be accessed from any computer and at any location all over the world.
9. Protocols are a set of rules and standards that define how data is exchanged and transmitted over a network.

   SMTP (Simple Mail Transfer Protocol); FTP (File Transfer Protocol)
10. File is defined as a program that stores the data organised in a specific format. A folder is a directory created for storing the related files or subfolders under a specific name.
11. Shopping: Our shopping habits have changed because of the online medium. Instead of going to the market, we can receive everything at our doorstep with online shopping. It not only saves our effort of going out but also provides us with options of reasonable prices.

    Communication: ICT helps us to communicate to our friends and relatives. There are more and more ways to talk to people without meeting them. For example through emails, video conferencing, video calls, etc.
12. Neetu should use a Multimedia Messaging Service (MMS) or an Instant Messaging app (like WhatsApp or Telegram) to share her recipes along with food photos with all her friends.

B. **Competency-based/Application-based questions:**

a

Lab Activity (Page 72)

Do it yourself.

4. Entrepreneurial Skills-I

Exercise

SECTION A (Objective Type Questions)

Quiz

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

B. 1. systematic 2. merchandise 3. Green
4. quality, availability 5. Entrepreneurship development

C. 1. Manufacturing 2. Hybrid 3. Entrepreneur 4. Founder

D. 1. True 2. False 3. False 4. True 5. True 6. True
7. True 8. False 9. True 10. False

Section B (Subjective Type Questions)

A. 1. A businessman is a person who starts a business based on an idea already existing in a society. For example, opening a grocery shop, mobile shop, etc.

2. Feedback in the long run: It is important to take feedback from the customers in the long run. You can use the feedback to improve your product and reach out to a larger group for future expansion of the business.

3. Entrepreneurship often involves facing challenges and uncertainties. Patience is essential to handle difficult times and waiting for the efforts to be paid, especially at the time of dealing with setbacks. It allows entrepreneurs to maintain a long-term perspective and make strategic decisions.

4. Three qualities of an entrepreneur are:

   Patience: Entrepreneurship often involves facing challenges and uncertainties. Patience is essential to handle difficult times and waiting for the efforts to be paid, especially at the time of dealing with setbacks.

   Positivity: A positive mindset is essential in overcoming obstacles and setbacks. It helps entrepreneurs to stay focused on solutions rather than problems even when he/she takes a big risk.

Hardworking, Never Giving Up and Perseverance: Hard work is the foundation for building and sustaining a successful business. Entrepreneurs should never give up in attaining their goals, even at the time of failures. It is important to learn from setbacks and keep on moving towards their goals.

5. Wage Employment: It exists as a partnership between two entities : the employer and the employee. In this type of employment, an employee receives compensation for their work in the form of wages or salary. It does not involve risks and the amount paid is fixed with certain incentives irrespective whether an employer is having loss or profit in his business.
6. Feeling a large responsibility for the business may sometimes be scary and brings a lot of mental instability. Funds management, unpredictable market, employees' reactions and sometimes less time for family may lead to emotional setback for an entrepreneur.
7. Market Leader who creates his own market.
8. Susan can consider starting the following service businesses with minimal investment:
   - Social Media Management
   - Event Planning
   - Personalized Coaching (Sales, Marketing, or Life Coaching)
   - Freelance Content Writing or Copywriting
   - Virtual Assistant Services
   - Online Tutoring
   - Cleaning or Home Organization Services
   - Digital Marketing Agency (low-cost ads, SEO)

   These require skills, time, and minimal capital.
9. Product Business: A business that is involved in the production and sale of any product. This type of business involves activities related to the manufacturing, distribution, and marketing of a product. For example, a sports shop, furniture shop.

   Service-based business: This kind of business provides services in the form of consulting, accounting, hospitality and many more of such types which can be delivered either physically or in a digital form through the Internet or mobile apps. These services are not in the physical form which can be touched or stored or bought from the retailers. They are provided by professionals or experts in such areas. Salon is an example of Service business.
10. Organisation: This plays an important role if a startup is launched at a large scale with a big investment. Though an entrepreneur is a person leading the whole business with his ideas but the other employees working in an organisation are equally important for the success of the startup.

B. Competency-based/Application-based questions:

1. a. Entrepreneur b. Employee c. Entrepreneur
2. a. Product b. service c. service

Lab Activity (Page 83)

Do it yourself.

5. Green Skills-I

Exercise

SECTION A (Objective Type Questions)

Quiz

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

B. 1. ecosystem 2. 8 3. recycled 4. Chemical fertilizers 5. aquatic

Section B (Subjective Type Questions)

A. 1. Carbon dioxide, Methane

2. Global warming refers to the increase in the average temperature of the Earth's atmosphere mainly due to greenhouse gases (carbon dioxide, CFC's) produced by a lot of human activities.

3. **Renewable:** Resources which occur in abundance and are renewed on their own by our mother nature through the natural process of recycling, replacement, and reproduction are called renewable resources. For example, forest, wind, water, sunlight, geothermal (energy from the heat inside the earth).

4. • Using renewable energy (example, using solar power and wind energy)
   • Water and waste management
   • Rain water harvesting

5. Green Transport: It supports a well-planned transportation system with minimum damage to the forest and environment. It also promotes efficient use of fuel that produces minimum greenhouse gases and also uses alternate sources of fuel like CNG, battery, etc.

6. An ecosystem is defined as a community where living and non-living things interact with each other and their surrounding environment to form a balanced system.

7. • Planting trees and grass
   • Building check dams
   • Using mulching techniques
   • Promoting terrace farming
   • Avoiding overgrazing

8. Water is an essential natural resource for the existence of life. Our body is made up of 70% of water. We need water for agricultural, industrial, household and recreational activities. We can conserve water by using the given measures:
    - By doing rainwater harvesting.
    - Setting up water treatment plants to reuse the water for irrigation or other purposes.
    - Judiciously using water at homes, restaurants, social gatherings and workplaces.

B. Competency-based/Application-based questions:

1. Environment-friendly fuels – I would suggest using biogas, LPG, solar cookers, or smokeless chulhas as they cause less pollution and are safer for health. These fuels produce less smoke, reducing air pollution and health problems. Using cleaner fuels also helps in conserving natural resources.
2. Disposing of books responsibly – I would donate usable books to needy students or libraries and send damaged ones for recycling to reduce waste and protect the environment. Reusing books saves paper and trees. Organizing a book donation drive in school can also help share knowledge with others.

Class 9

Answer Key

Artificial Intelligence Ver. 1.0

Part-B: Subject Specific Skills

1. AI Reflection, Project Cycle and Ethics

AI GAME 01 (Page 109)

1. Not always.
2. I was trying to study the most probable moves of the system.
3. Not really
4. It analysed the move of the player and predicted the next move based on its previous experience.

AI GAME 02 (Page 109)

1. Not always.
2. Try to make an outline of the object asked to draw so it may identify it.
3. Most of them

AI GAME 03 (Page 110)

Do it yourself.

AI Task (Page 113)

One advantage of AI: AI is branching out into every aspect of our lives and helping us live a better life. We use AI systems to interact with our phones and speakers through voice assistants like Siri, Alexa, and Google. Cars made by Tesla using AI for self-driving cars. Even Google gives us recommendations based on our activities.

One disadvantage of AI: AI machine lacks human emotions and creativity. AIs can become skilled machines but they can never acquire the abilities of humans. The creativity of AI is only limited to the ability of humans that created them.

AI Task (Page 116)

Do it yourself.

AI Task (Page 121)

Do it yourself.

Ai Task (Page 132)

Calculate the total number of pixels:

Total pixels=width×height

For an image with a resolution of 3264x2448 pixels:

Total pixels=3264×2448=7,990,272 pixels

Convert pixels to megapixels:

Megapixels=Total pixels/ 1,000,000

Megapixels=990,272/1,000,0007≈7.99 MP

So, an image with a resolution of 3264x2448 pixels is approximately 7.99 megapixels.

Ai Task (Page 142)

Do it yourself.

Exercise

SECTION A (Objective Type Questions)

Ai Quiz

A.

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

B.

1. machine learning algorithms
2. Ethics
3. image recognition and interpretation
4. computer vision system
5. NLP
6. iterative design
7. APIs (Application Programming Interfaces)
8. data

C.

1. False	2. False	3. False	4. True	5. True
6. False	7. True	8. True	9. False	10. True

SECTION B (Subjective Type Questions)

A.

1. Self-driving cars use computer vision to recognize and interpret road signs, obstacles, and pedestrians.
2. Healthcare (diagnostic tools), finance (fraud detection), and transportation (autonomous vehicles).
3. AI can transform industries, improve efficiency, solve complex problems, and enhance everyday life through automation, personalized services, and advanced decision-making.

4. Data statistics involves analyzing data to uncover patterns and trends, which helps AI systems make informed decisions and predictions.
5. To assess the performance of a classification model by displaying the number of true positive, true negative, false positive, and false negative predictions.
6. A leaf node represents the final classification or decision outcome in a decision tree, indicating the end of a decision path.
7. Data acquisition is the process of collecting and gathering data from various sources for analysis, training, and model development.
8. Weak AI and narrow AI are often used interchangeably. Both refer to AI designed for specific tasks, but weak AI generally implies limited capabilities, while narrow AI emphasizes its specialization in a particular function.
9. AI can assist in analyzing data from space missions, controlling spacecraft autonomously, optimizing mission planning, and detecting anomalies or patterns in space environments.
10. AI can lead to unemployment by automating tasks and jobs previously performed by humans, potentially reducing job opportunities in certain industries.

B. 1. **Artificial General Intelligence (AGI)** refers to AI systems that possess the ability to understand, learn, and apply intelligence across a broad range of tasks at a level comparable to human capabilities. AGI can perform any intellectual task that a human can, but it is still hypothetical and has not yet been achieved.

Artificial Super Intelligence (ASI), on the other hand, refers to AI systems that surpass human intelligence in all aspects, including creativity, problem-solving, and emotional understanding. ASI would be vastly superior to the most intelligent human minds and could potentially outperform human capabilities in every field. While AGI is a step towards achieving ASI, ASI remains a theoretical concept and presents significant ethical and safety concerns.

2.
- **Expensive Technology:** As AI is advancing day by day, the hardware and software need to get updated with time to meet the latest requirements. Setting up AI-based systems requires high costs because of the complexity of the engineering that goes behind its making. AI Reflection, Project Cycle and Ethics 187
- **Leads to Unemployment:** With the rapid development of AI, the fear of unemployment is constant. Jobs in manufacturing, agriculture, food service, retail, transportation, logistics, and hospitality are some of the industries likely to be affected. The majority of the repetitive tasks would be taken over by AI.
- **Lacks Emotions and Creativity:** AI machine lacks human emotions and creativity. AIs can become skilled machines but they can never acquire the abilities of humans. The creativity of AI is only limited to the ability of humans that created them.
- **Does Not Improve with Experience:** Humans learn from experiences, whereas it's not possible with machines. AIs cannot alter their responses based on the changing environment. They are programmed to behave in a specific manner, so they cannot make

decisions in case they encounter an unprogrammed situation. If a change is required, they need to be re-programmed.

- **Discouraging Human Creativity:** Apps like ChatGpt and others can be used with ease to do anything and everything.

3. Computer vision is crucial because it enables machines to interpret and understand visual information from the world, mimicking human vision. This technology is essential for applications such as autonomous vehicles, facial recognition, medical imaging, and surveillance systems. By allowing computers to process and analyze images and videos, computer vision facilitates a wide range of automated and intelligent tasks, enhancing efficiency and creating new possibilities in various fields.
4. **Healthcare:** AI assists in diagnosing diseases, personalizing treatment plans, and analyzing medical images for early detection of conditions like cancer.

   Finance: AI is used for fraud detection, algorithmic trading, and personalized financial advice, improving the accuracy and efficiency of financial operations.

   Customer Service: AI-powered chatbots and virtual assistants provide 24/7 support, handle customer inquiries, and automate routine tasks, enhancing customer experience and reducing operational costs.
5. **Manufacturing Workers:** Automation and robotics can replace repetitive and manual tasks in manufacturing, leading to job displacement.

   Customer Service Representatives: AI chatbots and virtual assistants can handle routine customer inquiries and support tasks, reducing the need for human representatives.

   Data Entry Clerks: AI and automation tools can process and input data more quickly and accurately than humans, potentially eliminating the need for manual data entry jobs.
6. **Data:** AI systems are the result of the data that is fed into them. The data used to train the AI system is the first step to check for biasness. The dataset for AI systems should be realistic and need to be of a sufficient size. However, the largest data collected from the real world may also reflect human subjectivity and underlying social biases. The Amazon AI recruitment system is a good example. It was found that their recruitment system was not selecting candidates in a gender-neutral way. The machine learning algorithm was based on the number of resumes submitted over a period of 10 years and most of them were men, so it favoured men over women.

   Algorithms: The algorithms themselves do not add bias to an AI model, but they can amplify existing biases. Let's look at an example of an image classifier model trained on images in the public domain—pictures of people's kitchens. It so happens that most of the images are of women rather than men. AI algorithms are designed to maximise accuracy. Therefore, an AI algorithm may decide that the people in the kitchen are women, despite some of the images being of men.
7. **Human rights:** This principle emphasises that AI solutions should respect, protect, and uphold fundamental human rights. This includes rights such as privacy, freedom of expression,

freedom from discrimination, and the right to a fair trial. AI systems should be designed and implemented in a way that they do not infringe upon these rights and should be held accountable if they do.

Bias: Bias in AI refers to the unfair or unjust treatment of individuals or groups based on characteristics such as race, gender, age, or socioeconomic status. Bias can be unintentionally introduced into AI systems through biased training data, flawed algorithms, or skewed decision-making processes. Addressing bias in AI involves identifying, mitigating, and preventing bias at every stage of the AI development lifecycle, from data collection and preprocessing to model training and deployment.

Privacy: Privacy concerns the protection of individuals' personal data and their right to control how that data is collected, used, and shared. AI systems often rely on vast amounts of data, which may include sensitive information about individuals. It is essential to implement robust privacy measures, such as data anonymisation, encryption, and user consent mechanisms, to ensure that AI solutions respect individuals' privacy rights and comply with relevant data protection regulations.

Inclusion: Inclusion in AI refers to ensuring that AI solutions are accessible, equitable, and beneficial for all members of society, regardless of factors, such as race, gender, disability, or socioeconomic status. This involves considering the diverse needs, perspectives, and experiences of different user groups throughout the design, development, and deployment of AI systems. Inclusive AI design aims to prevent the exacerbation of existing inequalities and to promote equal opportunities and outcomes for all individuals

8. Difference between ethics and morals:

Aspects	Ethics	Morals
Definition	Rules provided by an external source	Principles regarding right and wrong held by an individual
Source	Institutions, organisations, societal norms	Personal beliefs, cultural norms, religious teachings
Application	Specific situations and professional practices	Personal behaviour and conduct
Objective	Maintain order and fairness in society	Foster personal integrity and align with personal values
Examples	Medical ethics, business ethics, legal ethics	Personal beliefs about honesty, integrity, kindness
Origin	External and often codified	Internal and subjective
Scope	Consistent within a profession or society	Varies between individuals
Enforcement	Enforced by external bodies (e.g., professional organisations, legal systems)	Self-governed and enforced by individual conscience
Flexibility	Can change over time to reflect new norms or societal changes	More stable over time, but can evolve with personal growth

C. Competency-based/Application-based questions:

1. Recommendations based on user behavior and location data.
2. b. i.
3. a. i), ii) and iv)

Assertion and Reasoning Questions

4. a. Both A and R are true and R is the correct explanation of A.
5. d. A is false but R is true.

(Page 147)

a. If you don't select any of the given options in Inklewriter, the story will not progress to the next part. The user will be stuck at the current point in the narrative until they make a choice. This design ensures that readers make decisions that shape the story's direction, creating an interactive experience.

b. Yes, users can alter or add new options in the story. Inklewriter allows users to edit the existing options and add new choices, which lets them shape the narrative according to their creative vision. This flexibility helps in creating a more dynamic and personalized interactive story.

c. Yes, you can connect two different plots of the story together in Inklewriter. The platform supports branching narratives where different storylines can converge or diverge based on user choices. This feature allows for complex storytelling where different paths can eventually lead to the same or different outcomes.

d. Inklewriter itself doesn't use AI in the traditional sense of machine learning or data processing. However, the use of AI in similar interactive storytelling tools can be attributed to:

- **Personalization:** AI can help in analyzing user choices and tailoring the story dynamically to suit individual preferences.
- **Content Generation:** AI can assist in generating or suggesting narrative elements based on user input, creating more engaging and diverse storylines.
- **Complexity Management:** AI algorithms can manage and track numerous branching storylines and outcomes efficiently, ensuring a coherent and interactive narrative experience.

Inklewriter's focus is more on providing a user-friendly interface for creating interactive stories rather than using AI directly, but similar applications in interactive storytelling can benefit from AI in these ways.

2. Data Literacy

Δi Task (Page 151)

Wisdom	Technology in our day to day life, and our inability to avoid it even if we want to.
Knowledge	Impact of Technology on our social interactions, life style, and convenience.
Information	Different Technologies available, which are catering to different aspects of life, defense, space etc.
Data	What references to Technological Innovations can be presented to the audience

Ratings Given:

- First presentation: 'outstanding'
- Second presentation: 'poor'
- Third presentation: 'satisfactory'

Filtered Data:

- Ratings: 'outstanding', 'poor', 'satisfactory'
- Type: The ratings are qualitative and subjective measures of presentation quality.

Analysis:

- The ratings are not of the same type in a quantitative sense but are comparable in terms of their descriptive nature. They provide qualitative feedback on the presentations but do not offer numeric data.

Δi Task (Page 152)

Do it yourself

Δi Task (Page 154)

1. **Filter** the category by price, setting the filter from low to high to find the least expensive option.
2. **Evaluate** reviews and ratings by checking user feedback and overall ratings to determine the most popular product.
3. **Check** the product details and specifications to ensure it meets your specific needs and requirements.
4. **Review** the estimated delivery dates provided by the seller to plan accordingly.

Δi Task (Page 167)

Do it yourself

Exercise

SECTION A (Objective Type Questions)

AI Quiz

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

B. 1. Information literacy 2. Critical thinking 3. The DIKW pyramid
4. Secondary data sources 5. Data acquisition 6. knowledge
7. Attributes 8. Skills 9. A strong password
10. Data backup

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

D. 1. Computer Vision - b. Image Data
2. NLP - e. Qualitative Data
3. Textual Data - d. Data history
4. Sources of data - a. Data scraping
5. Data Discovery - c. Dataset search

SECTION B (Subjective Type Questions)

A. 1. i. A data pyramid, also known as the DIKW pyramid, represents the hierarchical relationship between data, information, knowledge, and wisdom. It illustrates how raw data can be processed to extract useful information, which in turn can lead to the formation of knowledge and ultimately wisdom.

ii.
- A: Data
- B: Information
- C: Knowledge
- D: Wisdom

iii.
- Data: Raw facts and figures without context.
- Information: Data processed and organized to be meaningful.
- Knowledge: Information analyzed and applied to make decisions.
- Wisdom: The ability to make sound judgments and decisions based on knowledge.

2. It enables individuals to make informed decisions by understanding and interpreting data accurately.

   It enhances critical thinking skills, allowing individuals to question assumptions and analyze data effectively.

3. Pie charts visually represent the proportions of different categories within a dataset, making it easier to compare and understand the relative sizes of each category.

4. Data interpretation provides insights and context to raw data, enabling decision-makers to understand trends, patterns, and correlations, which leads to more accurate and effective decisions.

   Training Data: It is data on which we train our AI project model. It is basically to fit the parameters of the project for the model. In training data, the output is available to the model.

   Testing Data: It is used to check the performance of an AI model. In testing data, the data is not seen for which the predictions have to be made.

5.

Quantitative Data	Qualitative Data
Data is depicted in numerical terms.	Data is not depicted in numerical terms.
Can be shown in numbers and variables like ratio, percentage, and more.	Could be about the behavioural attributes of a person, or things.
Examples: 100%, 1:3, 123	Examples: loud behaviour, fair skin, soft quality, and more.

6. Data processing involves tasks to refine raw data for analysis or application, including cleaning, organising, transforming, and summarising information. It ensures data accuracy, relevance, and accessibility for effective decision-making and analysis. It is crucial across various sectors like business, science, and technology, facilitating better utilisation of data assets. Data processing helps computers understand raw data. Use of computers to perform different operations on data is included under data processing.
7. Kaggle is an online platform for data science and machine learning competitions. It provides datasets, code, and community discussions, allowing data enthusiasts to practice and improve their skills, collaborate with others, and gain exposure to real-world problems.
8. Data backup refers to the process of creating copies of data to ensure that it can be restored in the event of data loss due to natural disasters, accidents, cyber-attacks, or other unexpected events. Sometimes physical backup media is used to secure in access-controlled environments. Another method to secure data can be the cloud backup which is considered more reliable.
9. This means the development and enhancement of data literacy skills are not static or one-time event. Instead, they evolve through continuous cycles of learning, application, and refinement.
10. Best practices that can help to ensure data privacy are:
    - Understanding what data you have collected, how it is handled, processed, used, and where it is stored.
    - Only necessary data required for a project should be collected.

B. 1. The ethical concerns while doing data acquisition are:
    - Take steps to understand and avoid any preferences or partiality in data.

- Take necessary permissions before collecting or using an individual's data.
- Explain how you intend to use the collected data and do not hide intentions.
- Protect the identity of the person who is the source of data.
- Take responsibility for your actions in case of misuse of data.

2. Cyber attacks are becoming more frequent as a result of the growing volume of data stored in the cloud. The best course of action given the volume of traffic being produced is to regulate and secure the transmission of private or sensitive data everywhere, that it is known to exist. Avoid entering sensitive information, such as your address, PAN, or Aadhar number on unrecognised and unsafe websites.

   The most possible reasons why data security is more important now are:

   - A constant fear cyberattacks affect all people.
   - The fast-technological changes will boom cyberattacks.
   - A persistent fear everyone is impacted by cyberattacks.
   - Rapid technical advancements will increase the frequency of cyberattacks.

3. AI systems often rely on vast amounts of data for training and operation. Unauthorised access and tampering could lead to inaccurate AI models and compromised outcomes. Many AI applications process sensitive data, such as personal, financial, or health-related information. Strong data security measures can stop data breaches and unauthorised access.
4. Best practices of cyber security are:
   - Use strong, unique passwords with a mix of characters for each account.
   - Activate Two-Factor Authentication (2FA) for added security.
   - Download software from trusted sources only and scan files before opening.
5. ` Numeric data can be further classified as:

Continuous Data	**Discrete Data**
Continuous data can take any numeric value within a specified range.	Discrete data refers to distinct single values. It consists of whole numbers without decimal parts that represent distinct categories or values.
Continuous data is measurable.	Discrete data is countable.
This type of data can be infinitely subdivided and often includes decimal points.	Discrete data cannot be subdivided meaningfully.
Often used to analyse using statistical techniques such as mean, median, standard deviation, and correlation.	It is used to analyse using frequency distributions, bar charts, and probability distributions.

Continuous Data	Discrete Data
Examples: dimensions of classroom, height, weight, temperature, time, etc.	Examples: number of girls and boys in class, number of subjects in class 9th, count of anything.

6. **Natural Language Processing (NLP)**

NLP is a subfield of AI that enables computers to understand and process human language.

Types of Data:

- Textual data: Articles, emails, social media posts.
- Audio data: Spoken language recordings transcribed into text.

Computer Vision

Computer Vision uses AI to help computers interpret images and videos.

Types of Data:

- Image data: Photos, satellite images, medical scans.
- Video data: Recorded videos.

Statistical Data

Statistical data analysis involves interpreting data to find patterns and insights for decision-making.

Types of Data:

- Numeric data: Data from tables and spreadsheets.
- Time series data: Data recorded at specific time intervals, like stock prices and weather data.

C. Competency-based/Application-based questions:

1. a. Quantitative data interpretation involves numerical data that can be measured and quantified, while qualitative data interpretation involves descriptive data that can be observed but not measured. Quantitative data interpretation methods include statistical analysis and graphical representation, which provide objective, precise, and comparable results. However, they may not capture the full context or nuances of the data and require a good understanding of statistical methods. On the other hand, qualitative data interpretation methods such as content analysis and thematic analysis provide in-depth insights and a deeper understanding of context. They capture the complexity of human experiences and perceptions but can be subjective, harder to generalize, and time-consuming.

   b. Quantitative data interpretation involves using descriptive statistics like mean, median, mode, and standard deviation, as well as inferential statistics like hypothesis testing and regression analysis. Visualization techniques such as bar charts, histograms, and scatter plots are also commonly used. These methods offer objectivity, generalizability, and

precision but may overlook context and complexity.

Qualitative data interpretation involves methods like content analysis, which includes coding textual data into manageable categories and identifying patterns, themes, and relationships. Thematic analysis develops themes from the data and analyzes them to interpret meanings and insights, while narrative analysis focuses on the stories and personal accounts in the data. These methods provide depth of understanding and context-rich insights but are subjective, limited in generalizability, and time-consuming.

By employing these methods and techniques, one can effectively interpret both quantitative and qualitative data, leveraging their respective strengths while being mindful of their limitations.

2. To present the company's sales performance across different regions during a quarterly review meeting, I would use bar graphs, line charts, and pie charts to convey trends and patterns effectively.

   A bar graph will be used to compare total sales across different regions, highlighting which regions are performing well and which are lagging. This visualization will help stakeholders quickly assess regional performance and facilitate discussions on strategic adjustments.

   A line chart will show sales trends over time for each region. This will help stakeholders observe how sales have fluctuated throughout the year, identify any seasonal patterns, and understand long-term trends. By seeing the sales trajectory, stakeholders can better predict future performance and make data-driven decisions.

   A pie chart will illustrate the percentage share of total sales by region, providing a quick visual overview of the sales distribution. This will help stakeholders understand the relative importance of each region to the company's overall sales.

   Using these visualizations, stakeholders will gain a comprehensive understanding of the sales performance across different regions, enabling them to make informed decisions based on clear, visual data insights.

Ai Lab (Page 180)

Do it yourself

3. Maths For AI (Statistics & Probability)

Ai Task (Page 182)

1. The given pattern appears to involve a series of multiplications of 2 with consecutive odd numbers.
2. 0, 1, 4, 9, 25, 16, 36

3. The skill used to identify the pattern is **pattern recognition** or **analytical reasoning**. This involves observing the sequence, identifying the mathematical relationship or rule governing the pattern, and applying this rule to find the missing elements.

Ai Task (Page 186)

Case 1: a cat

Case 2: a toffee

Case 2: ½

Ai Task (Page 187)

1/4

1/2

Ai Task (Page 189)

1. likely
2. unlikely
3. impossible
4. equal probability
5. certainly

Exercise

SECTION A (Objective Type Questions)

Ai Quiz

A.	1. b	2. c	3. b	4. b	5. d				
	6. d	7. c	8. a						
B.	1. AI	2. Meteorologists		3. Likely Events					
	4. Zero	5. Probabilistic	6. Equal	7. Probability	8. Disease prediction				
C.	1. True	2. False	3. True	4. False	5. True				
	6. False	7. True	8. True						

SECTION B (Subjective Type Questions)

A. 1. Mathematics and AI are interconnected fields, with Mathematics supplying the theoretical foundations for many AI algorithms. Patterns are repeating designs or sequences that can be observed in numbers, shapes, images, languages, or objects in our surroundings. They follow a specific order or arrangement, making them easily recognisable. Mathematics aids in the study of these patterns. These patterns allow you to solve puzzles. They help identify an order or arrangement in lists of images or numbers. They are present everywhere around us.

2. Patterns are regular and repeated ways in which data or events occur. For example, the sequence of even numbers (2, 4, 6, 8) or the seasonal patterns in weather data.
3. Equal probability events are events that have the same chance of occurring. For example, when flipping a fair coin, the probability of getting heads or tails is equal.
4. Collecting data is the first step in statistics and involves gathering relevant information from various sources to analyze and draw conclusions.
5. Two applications of statistics in real life are:
   - Analyzing consumer behavior in marketing to improve product sales.
   - Assessing the effectiveness of medical treatments in healthcare.
6. The probability of wearing a white dress is 313\frac{3}{13}133.
7. One use of statistics in disaster management is to analyze past disaster data to predict and prepare for future events.
8. One use of probability in finance is to assess the risk of investment portfolios and predict future market trends.

B. 1. **"Statistics is used for collecting, exploring, and analyzing the data."** Statistics involves several key steps: First, data collection involves gathering relevant information from various sources such as surveys, experiments, or observational studies. For instance, if a company wants to understand customer satisfaction, it would collect data through customer feedback surveys. Next, exploring the data involves summarizing and visualizing it to uncover patterns and trends. This could mean creating charts or tables to see the distribution of satisfaction levels. Finally, analyzing the data involves applying statistical methods to draw conclusions and make predictions. For example, statistical tests might reveal that customers who receive timely support are more satisfied. Thus, statistics helps in making informed decisions based on data.

2. **Three uses of statistics in education:**
   - Analysing test scores and grades to evaluate student learning, identify areas for improvement, and allocate resources effectively.
   - Using data to identify gaps in the curriculum and areas where students need more support.
   - Analysing how students and teachers use educational technology for future implementations.
3. Concept of probability with a deck of 52 cards: Probability measures the likelihood of an event occurring. In a standard deck of 52 cards, there are 4 suits (hearts, diamonds, clubs, spades) with 13 cards each. If you want to calculate the probability of drawing a card from a particular suit, say hearts, you would use the formula for probability:

   Probability=Total number of outcomes/Number of favorable outcomes = 13/52=1/4

   So, the probability of drawing a heart from the deck is 1/4, or 25%.

4. **Likelihood of an event with examples:** The term "likely" describes events that have a high chance of occurring but are not guaranteed. For example, consider the likelihood of drawing a card from a standard deck of 52 cards and it being a face card (Jack, Queen, or King). There are 12 face cards in a deck:

   Probability=Number of face cards/Total number of cards= 12/52

   This probability suggests that while it's not certain, it's relatively likely to draw a face card compared to other outcomes.

5. **Role of probability in estimating road traffic:**
   - **Predicting Peak Traffic Hours:** Probability models help forecast times of day when traffic congestion is most likely based on historical data. For instance, if data shows heavy traffic between 8-9 AM, probability helps in planning routes to avoid congestion.
   - **Traffic Light Timing:** Probability helps in optimizing traffic light timings to minimize delays. If traffic data indicates high vehicle volume at certain times, light cycles can be adjusted to improve flow.
   - **Assessing Traffic Jam Risks:** Probability estimates the likelihood of traffic jams during special events or adverse weather conditions. For example, if an event is expected to draw large crowds, probability models can predict increased traffic and help in managing road usage.

6. Likely, unlikely, impossible, and equal probability events:
   - **Tossing a Coin:** Equal probability (both heads and tails have a 50% chance of occurring).
   - **Rolling an 8 on a Standard Die:** Impossible (a standard die only has faces numbered 1 to 6).
   - **Throwing Ten 5's in a Row:** Unlikely (the probability is very low, as the chance of getting a 5 on a single throw is 1/6, and this event occurring consecutively ten times is rare).
   - **Drawing a Card of Any Suit:** Likely (every card drawn from the deck will be of one of the four suits, so it's guaranteed that a suit will be drawn).

7. Examples of impossible and equal probability events:
   - **Impossible Events:**
     - **Rolling a 7 on a Standard Die:** A standard die has only six faces, so rolling a 7 is impossible.
     - **Drawing a Card from an Empty Deck:** If a deck has no cards, drawing one is impossible.
   - **Equal Probability Events:**
     - **Tossing a Fair Coin:** Each side (heads or tails) has an equal chance of landing face up.
     - **Rolling a Fair Six-Sided Die:** Each number (1 through 6) has an equal chance of appearing.

8. Certain Events and Likely Events with Examples:
    - **Certain Events:** These are events that are guaranteed to happen. For example, the sun rising in the east each morning is a certain event.
    - **Likely Events:** These are events that have a high chance of occurring but are not guaranteed. For example, during the winter season in a cold climate, it is likely to snow, but it is not certain every day.

C. Competency-based/Application-based questions:

1. The student can prioritize studying the topics with the highest probabilities of appearing on the exam. For instance, Topic A with a probability of 0.8 and Topic D with a probability of 0.7 are more likely to be on the exam, so the student should focus more on these topics. This targeted preparation can increase the chances of performing well in the exam by ensuring the student is well-prepared for the most likely topics.
2. Role of statistics in launching a new smartphone:

    Statistics help the company analyze market research data to understand consumer preferences, potential demand, and market trends. By using statistical techniques such as surveys, regression analysis, and forecasting models, the company can make data-driven decisions about product features, pricing, and marketing strategies. This reduces the risk of product failure and helps in aligning the product with market needs.
3. Applications of probability in predicting earthquakes:
    - **Seismic Risk Assessment:** Probability models estimate the likelihood of earthquakes occurring in different regions based on historical data and fault lines. This helps in identifying areas at higher risk and planning for mitigation.
    - **Aftershock Forecasting:** After a significant earthquake, probability models predict the likelihood and intensity of aftershocks, helping in emergency response and preparedness.
4. Examples of probability theory in artificial intelligence:
    - **Spam Filtering:** AI uses probability to classify emails as spam or not based on the likelihood of certain words or patterns appearing in spam emails. This helps in effectively filtering out unwanted messages.
    - **Recommendation Systems:** Probability models predict which products or content a user is likely to be interested in based on their past behavior and preferences, enhancing the accuracy of recommendations.

AI In Life (Page 194)

Do it yourself

AI Deep Thinking (Page 194)

Do it yourself

Class Activity (Page 195)

Do it yourself

4. Introduction to Generative AI

Ai Task (Page 206)

Do it yourself.

Ai Task (Page 207)

Do it yourself.

Ai Task (Page 208)

Do it yourself.

Ai Task (Page 209)

Do it yourself.

Ai Task (Page 209)

Do it yourself.

Exercise

SECTION A (Objective Type Questions)

Ai Quiz

A.

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

B.

1. Unsupervised	2. Ethical	3. Generative AI
4. Generative AI	5. Sequential	
6. Real	7. Images	8. Runway ML

C.

1. True	2. True	3. False	4. True	5. True
6. False	7. False	8. True	9. False	10. False

D.

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

SECTION B (Subjective Type Questions)

A. 1. Autoencoders compress data into a latent space and then reconstruct the input data, focusing on dimensionality reduction. VAEs, on the other hand, generate new data points by learning the distribution of the input data and sampling from this distribution.

2. The examples of VAE are:

   Example 1: VAE for generating handwritten digits (MNIST dataset).

   Example 2: VAE for generating faces using the CelebA dataset.

3. AlphaGo was introduced in October 2015.
4. Example 1: GPT-3 (by OpenAI)

   Example 2: DALL-E (by OpenAI)

   Example 3: StyleGAN (by NVIDIA)

   Example 4: Artbreeder

5. **Generative AI:** Used for creating new content such as text, images, music, and videos. Examples include generating realistic human faces, writing essays, and composing music.

   Conventional AI: Typically used for tasks such as classification, regression, prediction, and optimization. Examples include fraud detection, recommendation systems, and speech recognition.

6. Generative AI models require large datasets to capture the variability and complexity of the data distribution they aim to model. The quality and diversity of the generated outputs depend on the richness of the training data. Insufficient data can lead to overfitting and poor generalization, resulting in less realistic or diverse generated content.
7. Generative AI models can perpetuate and amplify biases present in the training data. If the training data contains biased representations or stereotypes, the generated outputs can reflect and reinforce these biases. This can lead to unfair or harmful outcomes, especially in sensitive applications like hiring, law enforcement, or healthcare.
8. Important features of Artbreeder are:

   Feature 1: Allows users to blend and evolve images to create unique artworks.

   Feature 2: Provides sliders for users to adjust different attributes of images, such as age, gender, and art style.

9. **Consideration 1:** The potential for misuse in creating deepfakes, which can be used for malicious purposes such as misinformation, fraud, and invasion of privacy.

   Consideration 2: The need for transparency and accountability in the use of generative AI, ensuring that users are aware when they are interacting with AI-generated content.

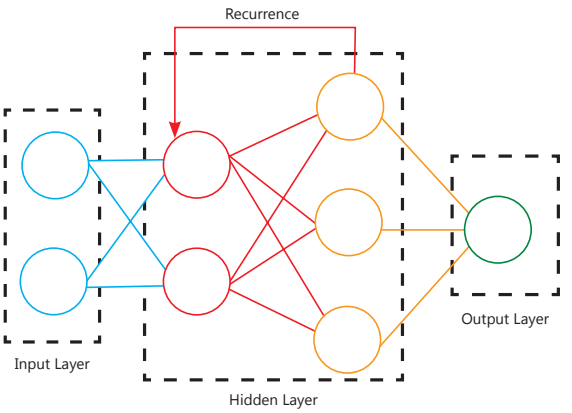
10. Generative AI can pose privacy risks by generating realistic synthetic data that can be used to impersonate individuals or reconstruct private information. Additionally, if generative models are trained on sensitive data without proper anonymization, they can inadvertently leak confidential information, leading to data breaches and misuse.

B. 1. Generative AI has transformed music creation and production. Tools like OpenAI's MuseNet can compose music in various genres, while Amper Music generates custom tracks by setting parameters such as mood and tempo, making music production more accessible. Platforms like Endel create personalized soundscapes based on user activities, enhancing listening experiences. In addition, AI can suggest different arrangements and instrumentations, aiding composers in exploring new sounds. AI also improves old recordings by removing noise and

filling gaps. AIVA (Artificial Intelligence Virtual Artist) is an example, composing symphonic music for films, ads, and games.

2. Autoencoders (AEs) are neural networks that learn to compress data into a latent space and then reconstruct it. They are used for tasks like dimensionality reduction and feature learning. Key features include:
   - **Dimensionality Reduction:** Compresses data to lower dimensions for easier visualization and reduced computational cost.
   - **Data Denoising:** Removes noise from data, improving quality.
   - **Anomaly Detection:** Identifies outliers by reconstructing normal data poorly.
   - **Feature Learning:** Learns useful features for tasks like classification.

   Examples include image compression, denoising photographs, and fraud detection.

3. 

4. **Architecture:** Generates multiple design variations and optimizes plans, enhancing creativity and efficiency.

   Coding: Generates boilerplate code and suggests completions, increasing productivity and reducing development time.

   Music: Composes original music and generates background scores, providing new tools for creativity.

   Content Creation: Produces high-quality written content, realistic images, and videos, enabling quick production of diverse media.

C. Competency-based/Application-based questions:

1. **Verify Sources:** Ensure the AI-generated content is cross-referenced with credible sources.

   Avoid Plagiarism: Use AI tools to generate ideas and outlines but write the essay in your own words.

Understand the Topic: Use AI for research and learning, but make sure you understand the material thoroughly.

Cite Properly: If using AI-generated content, ensure it is properly cited to avoid plagiarism.

Ethical Use: Avoid using AI to generate the entire essay; instead, use it to enhance your understanding and provide additional perspectives.

2. Generative AI can revolutionize the creative industry by enabling the generation of unique and innovative designs. In art, AI can create new styles and compositions, offering artists novel ideas and expanding their creative horizons. In fashion, AI can design clothing and accessories, predict trends, and customize designs for individual preferences. This technology fosters creativity by providing diverse and original concepts that may not have been conceived by human designers alone.
3. To ensure responsible use of generative AI, it is crucial to establish guidelines and regulations that balance benefits and risks. These guidelines could include:

   Transparency: Ensuring AI-generated content is clearly labeled.

   Accountability: Implementing accountability measures for creators and users of AI.

   Bias Mitigation: Developing methods to detect and mitigate biases in AI-generated content.

   Privacy Protection: Safeguarding personal data used in AI training and generation.

   Ethical Standards: Encouraging adherence to ethical standards in AI development and usage.

   Balancing the potential benefits and risks involves fostering innovation while protecting individuals and society from potential harm.
4. Parameter 1: Human-Like Response

   ChatGPT: Highly conversational and natural language generation.

   Gemini: Focuses on natural language understanding with precise and coherent responses.

   Copilot: Provides code suggestions with a conversational aspect for coding assistance.

   Parameter 2: Training Dataset and Underlying Technology

   ChatGPT: Trained on a diverse dataset using GPT architecture.

   Gemini: Uses proprietary datasets and technology optimized for dialogue.

   Copilot: Based on OpenAI Codex, trained on a large dataset of code from GitHub.

   Parameter 3: Authenticity of Response

   ChatGPT: High-quality responses but may occasionally generate plausible-sounding incorrect information.

   Gemini: Emphasizes accurate and reliable information.

   Copilot: Focused on accurate code generation and documentation.

   Parameter 4: Access to the Internet

   ChatGPT: No real-time internet access.

Gemini: Typically does not access the internet in real-time.

Copilot: No real-time internet access, trained on static data.

Parameter 5: User Friendliness and Interface

ChatGPT: User-friendly with intuitive interfaces across platforms.

Gemini: Designed for ease of use in conversational contexts.

Copilot: Integrated into code editors for seamless coding assistance.

Parameter 6: Text Processing: Summarisation, Paragraph Writing, Etc.

ChatGPT: Excellent at summarization and generating coherent paragraphs.

Gemini: Strong in generating concise and relevant text.

Copilot: Primarily focuses on code-related text generation.

Parameter 7: Charges and Price

ChatGPT: Various pricing tiers, including free access with limitations.

Gemini: Pricing depends on usage and integration specifics.

Copilot: Subscription-based model, typically around $10/month.

5. Idea Generation: Use AI to generate initial concepts and inspiration for the bridge design.

   Sketch Variations: Generate multiple design variations to explore different possibilities quickly.

   Refinement: Use AI-generated sketches as a base to refine and develop unique designs.

   Collaborative Tool: Collaborate with classmates or mentors to review and improve AI-generated concepts.

   Ethical Use: Ensure originality by not solely relying on AI-generated designs; use them as a tool for inspiration and enhancement.

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

Ai Lab (Page 215)

1. Do it yourself.
2. Do it yourself.

5. Introduction to Python

Ai Task (Page 377)

Do it yourself.

Exercise

SECTION A (Objective Type Questions)

Ai Quiz

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

B. 1. algorithm 2. 10 3. Flowchart
4. Documentation 5. Guido van Rossum, www.python.org
6. =, += 7. None 8. sequential 9. Traversal
10. Negative 11. Syntax 12. clear()

C. 1. True 2. False 3. True 4. True 5. True
6. False 7. True 8. True 9. True 10. False

D. 1.
```
x = 10
a = input("enter number: ")
print("number entered is", a)
b = 10
a = int(a) + 5
a = a + 10
print(a)
```

2.
```
y = int(input("Enter Y: "))
if y < 10:
    print("smaller")
else:
    print(y)
```

3.
```
M = int(input("Enter M: "))
while M < 10:
    if M == 5:
        print("Middle Value")
    else:
        print(M)
    M += 1
```

4.
```
str = "book"
i = 0
while i <= 1:
    print(str, sep="%")
    i += 1
```

E. 1.
```
C = 1
while C < 5:
    print(C)
    C += 2
    print("Python")
```
2.
```
sum = 0
for i in range(20, 10, -2):
    sum += i
    print(sum)
```

F. 1.
```
Output:
1022*1024*1026*1028*
```
2.
```
Output:
50
```
3.
```
Output:
0*2*4*
```

SECTION B (Subjective Type Questions)

A. 1. The two coding programs available in CodeCombat are Python and JavaScript.

2. Flowcharts are more preferred because they are visual, easier to understand, and clearly show the flow of the program using symbols.

3. Yes, we can write multiple algorithms for the same problem as there can be different ways to solve a problem based on logic and approach.

4. Selection flow allows the program to choose between different paths based on a condition using statements like if, if-else, or if...elif...else.

5. Multi-line strings in Python can be created using triple quotes, either ''' or """.

6. The print() function is used to display output on the screen.

   Example:
```
print("Hello")
print(5 + 3)
print("Age is", 12)
```

7. Variables are names used to store data. They are important because they allow programs to store, change, and reuse values during execution.

8. Normal division (/) gives the result with decimals, while floor division (//) gives the largest whole number less than or equal to the result.

9. Sequential programming means the instructions in a program are executed one after another in the order they are written.

   Consideration 2: The need for transparency and accountability in the use of generative AI, ensuring that users are aware when they are interacting with AI-generated content.

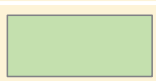
10. A nested if statement is an if statement placed inside another if statement to check multiple conditions.
11. Step value helps control the number of loop repetitions and prevents the loop from running infinitely.
12. A while loop is called an entry-controlled loop because the condition is checked before the loop body is executed.
13. The sort() function is used to arrange the elements of a list in ascending or descending order.
14. Key features of Python include simple syntax, readability, large library support, and cross-platform compatibility.

    Applications include web development, AI, machine learning, automation, data science, and game development.
15. The pop() function removes an element by index and returns it, while remove() deletes the first matching value from the list.
16. False – Because the comparison goes element by element, and 6 is not less than 5.

B. 1.

Algorithm	Flowchart
It is a step-by-step textual approach to solve a problem.	It is a graphical representation of a algorithm.
It can be written in natural language, pseudocode, or code.	It uses standardised symbols and shapes.
Difficult to represent branching and looping.	Easily represents branching and looping through symbols.

2.

Symbol Names	Symbols	Purpose
Oval		Used to start and stop a flowchart.
Parallelogram		Used to take input and display output.
Rectangle		Used to perform assignment, mathematical and processing operations.

3. To solve this problem of writing a program, we follow some steps as given below:

   i. Understanding the problem: This is a crucial step where we need to understand the main objective of the problem. In this step, we should clearly define the problem, gather all necessary requirements, understand constraints, and clarify goals. These actions are essential to moving in the right direction and finding an effective solution.

   ii. Analysing the problem: Break down the problem into smaller parts, identify inputs and outputs, and explore existing solutions. Consider edge cases and unusual scenarios. This comprehensive analysis sets a detailed plan for tackling the problem.

iii. Developing the solution: Design a detailed algorithm and choose appropriate tools and technologies. It is always recommended to first write an algorithm and draw a flowchart for solving a problem and then only write the program. This translates analysis into a practical, actionable plan.

iv. Coding and implementation: This is the last step where every instruction of an algorithm is converted into a computer understandable instruction by using the syntax and semantic of a specific computer language.

4. Control structures are a set of instructions that control the flow of instructions in a program. It is a programming tool that determines the order of execution of the statements in any programming language. There are three different types of control structures: sequential flow, selection flow, and repetition flow. Let us learn about these in detail.

   Sequential Flow

   In sequential flow, the statements are placed one after the other and the flow of execution occurs starting from line 1, line 2 and so on with a top-down approach. It is the default flow followed in any programming language. For example, the steps for calculating the percentage of any student by taking as an input marks of English, Science, Maths are as follows:

   Step 1 Start

   Step 2 Input Eng, Science, Math

   Step 3 Total = Eng+Science+Math

   Step 4 Percentage = (Total / Maximum_Marks) * 100

   Step 5 Display Percentage Step 6 Stop

   Selection Flow Selection flow is also known as branching control as the flow of control branches based on a condition. A condition evaluates to either TRUE or FALSE. In the case of TRUE, the flow of control follows the set of instructions written for True. In case it is FALSE, then it follows the other route. For example, consider the scenario where an award is given only if the percentage is more than 90:

   Step 1 Start

   Step 2 Input Eng, Science, Math

   Step 3 Total = Eng+Science+Math

   Step 4 Percentage = (Total / Maximum_Marks) * 100

   Step 5 Display Percentage

   Step 6 If Percentage> 90 then

   Display "Award given"

   Step 7 else

   Display "No award"

Step 8 Stop

Repetition Flow Repetition flow, also known as a loop, repeats a set of instructions a number of times based on a condition. For example, if we wish to repeat the above steps of calculating percentage for 10 students then we use the concept of repetition.

Step 1 Start

Step 2 count=1

Step 3 if count <=10 goto Step 4 else goto step 10

Step 4 Input Eng,Science, Math

Step 5 Total= Eng+Science+Math

Step 6 Percentage = (Total / Maximum_Marks) * 100

Step 7 Display Percentage

Step 8 count=count+1

Step 9 Goto Step 3

Step 10 Stop

5. Arithmetic operators are used to perform mathematical operations on variables and values. Following arithmetic operators are provided by Python:

Name	Symbol	Purpose	Example	Output
Addition	+	Adds two values.	2 + 4 2.0 + 4 "hi" + "all"	6 6.0 "hiall"
Subtraction	–	Subtracts second value form the first value.	6 – 2 6.0 – 2	4 4.0
Multiplication	*	Multiplies two values.	2 * 3 1.5 * 2 "Hi" * 3	6 3.0 'HiHiHi'
Division	/	Divides the first number with the second number.	4 / 2 6.0 / 2 6 / 2.0 11 / 2	2.0 3.0 3.0 5.5
Remainder or Modulus	%	Returns the remainder of a division.	5 % 2 16 % 11	1 5

Exponential	**	Second number raised to the power of the first number.	5 ** 2 1.5 ** 2	25 2.25
Floor division	//	Divides the first number with the second number and returns the whole number adjusted left to the number line.	11 // 2 -11 // 2 13 // 4 -13 // 4	5 –6 3 –4

6. Comments are used to increase the readability of the code. We use them to give a proper understanding of the code in simple English statements. They are completely ignored by the Python interpreter. It is always a good practice to add comments in your code so that if anybody in the future wishes to understand or modify your code, then through comments it will be easy to interpret the instructions. There are two different ways of writing comments in Python. Let us learn about them in detail.

Single Line Comment

Single line comment starts with hash symbol # followed by the text to be written as a comment that lasts until the end of the line.

For example,

```
# assigning a value to a variable
num1 = 10
num2 = 20
# calculating the average
(num1 + num2) / 2
```

Multiple Line Comments When we add up comments which occupy two or more lines then we begin the comment with either 3 times single quotes ''' or double quotes """, followed by text on multiple lines and end with single quotes ''' or double quotes """ to mark the end of the comment.

For example,

```
"""This program calculates the average
of two numbers stored
in two different variables"""
a = 10
b = 20
c = (a + b) / 2
```

7. Numbers: Data with a numeric value falls into this category. It can be integer, float and complex. Python will automatically convert a number from one type to another if needed. Following are some number types:
   - Integer: Integers are whole numbers (+ve, -ve or 0) with no fractions or decimal value. Range of an integer in Python can be from -2147483648 to 2147483647, and long integer has unlimited range subject to available memory. For example, 10, 124, 4567, 7812568751.
   - Float: It is a real number with floating point representation. For example, 15.5 and 12.0. It can also be represented using the exponent notation E. For example, 1E5 is 100000.
   - Complex: It is made up of a real number and an imaginary number. For example, 3+2j where 3 is a real number, 2 is an imaginary number, and j is the imaginary unit.
8. There are three kinds of errors which a programmer encounters in Python: syntax error, logical error and runtime error. Let us learn about them in detail.

   Syntax Error

   Syntax refers to the rules for writing code in the Python language. A syntax error occurs when these rules are violated. This is the most common type of error made by a programmer.

   Syntax errors can result from typing errors, incorrect indentation, or providing incorrect arguments to a function. When Python encounters a syntax error, it cannot interpret the instruction and will raise an error. In IDLE, syntax errors are highlighted by an arrow, indicating the line where the error occurred. You can then go to that line to rectify the error. Some examples of syntax errors include:

```
a + b = c
SyntaxError: cannot assign to operator
myname = Arshia
SyntaxError: EOL while scanning string literal
a = 5
b = 10
c = a + b
SyntaxError: unexpected indent
print("Python"))
SyntaxError: unmatched ')'
```

   Logical Error

   This kind of error is difficult to find since the program will run correctly but the desired output is not achieved. This happens if we give a wrong formula for the calculation to be done, write wrong logic for the problem to be solved through the code.

   For example, To calculate the average:

   p = marks1 + marks2 / 2 #instead of (marks1+marks2) / 2

Preceding code produces a wrong output due to the logical error in formula. Let us take another example.

To find the perimeter of rectangle,

p = 2 * l + b #instead of p = 2 * (l + b)

Runtime Error Runtime errors occur during the execution of a program and can result from various issues such as incorrect input or output, undefined object errors, or division by zero errors. These errors can halt the program's execution unexpectedly, making them challenging to debug.

Example of runtime error is:

a = int(input("enter first number"))

b = int(input("enter second number"))

c = a / b If a = 5 and b = 0,

then it will display:

ZeroDivisionError: division by zero

9. Type conversion is the process of converting the value of one data type into another data type. It is commonly used in programming when data needs to be manipulated or matched with a different data type for a particular operation.

   There are two types of type conversion in Python:

   1. Implicit Type Conversion (Automatic Conversion)

      In this type, Python automatically converts one data type to another without user involvement. This usually happens when a smaller data type is combined with a larger data type.

      Example:

      x = 10 # Integer

      y = 2.5 # Float

      z = x + y # Integer + Float Æ Float

      print(z) # Output: 12.5

      print(type(z)) # Output: <class 'float'>

   2. Explicit Type Conversion (Type Casting)

      In this type, the programmer manually converts the data type using built-in functions like int(), float(), str(), bool(), etc.

      Example:

      a = "100"

      b = int(a) # Converting string to integer

      print(b + 50) # Output: 150

      In this example, a is a string. It is explicitly converted to an integer using int() before performing arithmetic.

10. The for Loop The for loop is used to repeat a set of instructions for a fixed number of times. This means the number of iterations are known/definite before we start the execution of the loop. Therefore, the for loop is also known as definite loop. Indentation of statements is must to specify the block of statements to be repeated using the for loop.

There are commonly two different ways of using the for loop:

- Using Sequence: In this type of for loop, a sequence of values is used over which the loop iterate. The syntax to use the for loop with a sequence is:

  for <counter variable> in <sequence> :

  Statements

  Different examples of for loop are:

Commands	Output
`for i in [1,2,3,4]:` `  print(i)`	1 2 3 4
`for words in ["hello", "friends", "how are you?"]:` `  print(words)`	hello friends how are you?
`for alphabets in "hello!":` `  print(alphabets)`	h e l l o !

Using the range() Function: The range( ) function is an inbuilt function that is used to generate a sequence of values between the specified range. The syntax to use the for loop with a range () function is:

```
for <Var> in range(<Start>, <End>, <Step>):
   Statements
```

Different examples of for loop with the range( ) function are:

Commands	Output

`for count in range(1,6,1):`
`  print("hello")`
`print("Program ends")`
	hello
	hello
	hello
	hello
	hello
	Program ends

`for var in range(1,10,2):`
`  print(var,end=",")`
`for count in range(1,10):`
`  print(count,end=",")`
	1,3,5,7,9
	1,2,3,4,5,6,7,8,9

The while loop is used to repeat a set of instructions as long as the condition is true. It means when the number of iterations are not fixed/indefinite before we start with the execution of a loop. Therefore, it is known as an indefinite loop. Indentation of statements is required to specify the block of statements to be repeated using a while loop. This loop is also called an entry-controlled loop as it checks for the condition in the beginning. If the condition is 'True' then the body of the loop will be executed. If the condition is 'False' then it will not be allowed to enter within the loop and it stops. The syntax of the while loop is:

```
while <condition>
   Statements
```

The different examples of while loop are:

Commands	Output

`count=1`
`while count<=5:`
`  print("hello")`
`  count+=1`
`print("Program ends")`
	hello
	hello
	hello
	hello
	hello
	Program ends

`i = 1`
`while i < 6:`
`  print(i)`
`  i += 1`
	1
	2
	3
	4
	5

`"""Input a number and check`
`for even or odd.`
`The whole process should`
`continue till the user`
`wants"""`
`ans = "y"`
`while ans=="y":`
`  num=int(input("enter a`
`  number:"))`
`  if num%2==0:`
`  print(num," is Even")`
`  else:`
`  print(num," is Odd")`
`  ans=input("Press 'y' to`
`  continue:")`
`print("Program ends here")`
	enter a number: 3
	3 is Odd
	Press 'y' to continue: y
	enter a number: 6
	6 is Even
	Press 'y' to continue: y
	enter a number: 12
	12 is Even
	Press 'y' to continue: n
	Program ends here

11. Rules:
    - for, in, and range are keywords.
    - Start, End, and Step are parameters of range() function and will always be integers.
    - Start is a starting value of loop, End is an ending value (not inclusive) of loop, and Step is the number of steps taken to reach the end value.
    - If only two parameters are used then Step value becomes 1 by default.
    - If only one parameter is used the Start becomes 0 and Step becomes 1 by default.
    - If Start > End then Step should be a negative integer.
    - If Start < End then Step should be a positive integer.
    - If Start >= End and Step value is not specified, the loop will not execute as this is an invalid condition.
12. There are two main ways of indexing in a list in Python:

    Positive Indexing: In positive indexing, the index starts from 0 for the first element and increases by 1 for each subsequent element.

    Example:

```
fruits = ['apple', 'banana', 'cherry', 'date']
print(fruits[0]) # Output: apple
print(fruits[2]) # Output: cherry
```

    Negative Indexing: In negative indexing, the index starts from -1 for the last element and goes backward.

    Example:

```
fruits = ['apple', 'banana', 'cherry', 'date']
print(fruits[-1]) # Output: date
print(fruits[-3]) # Output: banana
```

C. 1.

```
a = int(input("Enter first angle: "))
b = int(input("Enter second angle: "))
c = int(input("Enter third angle: "))
if a + b + c == 180:
   print("The angles form a triangle.")
else:
   print("The angles do not form a triangle.")
```

2.

```
seconds = int(input("Enter time in seconds: "))
minutes = seconds / 60
print("Time in minutes:", minutes)
```

3.

```
area = (22 / 7) * 5 * 5
print("Area of the circle:", area)
```

4.
```
length = int(input("Enter length: "))
breadth = int(input("Enter breadth: "))
if length == breadth:
    print("It is a square.")
else:
    print("It is not a square.")
```

5.
```
day = int(input("Enter a number (1-7): "))
weekdays = ["Monday", "Tuesday", "Wednesday", "Thursday", "Friday",
"Saturday", "Sunday"]
if 1 <= day <= 7:
    print("Weekday is:", weekdays[day - 1])
else:
    print("Invalid number.")
```

6.
```
val1 = False
val2 = 15.6
print(val1 and val2)
```

7.
```
salary = float(input("Enter salary: "))
years = int(input("Enter years of service: "))
if years > 5:
    bonus = salary * 0.15
    salary += bonus
    print("Net salary:", salary)
```

8.
```
val1 = "Zero"
val2 = True
print(bool(val1) + val2)
```

9.
```
amount = float(input("Enter billing amount: "))
if amount > 5000:
    discount = amount * 0.10
    amount -= discount
    print("Net billing amount:", amount)
```

10.
```
val1 = True
val2 = "Hello"
print(str(val1) + val2)
```

11.
```
val1 = "Morning "
val2 = 90.4
try:
    print(float(val1) + val2)
except ValueError:
    print("Cannot convert string to float.")
```

Ai Lab (Page 261)

1. Step 1 Start
   Step 2 Input Basic, Allowances, and Deductions
   Step 3 Calculate Net Salary = Basic + Allowances – Deductions
   Step 4 Print Net Salary
   Step 5 End
2. Step 1 Start
   Step 2 Input mark1 and mark2
   Step 3 If mark1 > mark2, print mark1
   Else, print mark2
3. a.
```
c = float(input("Enter temperature in Celsius: "))
f = (c * 1.8) + 32
print("Temperature in Fahrenheit:", f)
```
   b.
```
names = [input("Enter name: ") for _ in range(5)]
print(" ".join(names))
```
   c.
```
a = input("Enter first value: ")
b = input("Enter second value: ")
temp = a
a = b
b = temp
print("After swapping:", a, b)
```
   d.
```
km = float(input("Enter distance in kilometre: "))
m = km * 1000
print("Distance in metre:", m)
```
   e.
```
side = float(input("Enter side of square: "))
area = side * side
print("Area of square:", area)
```

f.
```
lst = [1, 2, 3, 4, 5, 6]
for i in range(0, len(lst)-1, 2):
    lst[i], lst[i+1] = lst[i+1], lst[i]
print("Updated list:", lst)
```

g.
```
cities = [input("Enter city: ") for _ in range(5)]
name = input("Enter city to search: ")
if name in cities:
    print("City found in the list.")
else:
    print("City not found.")
```

h.
```
marks = [float(input("Enter marks: ")) for _ in range(5)]
total = sum(marks)
percentage = total / 5
print("Percentage:", percentage)
```

i.
```
lst = [10, "hello", 3.14, True, 25]
for item in lst:
    if type(item) == int:
        print(item)
```

j.
```
marks = [int(input("Enter marks: ")) for _ in range(5)]
for mark in marks:
    if mark > 50:
        print(mark)
```

4. a.
```
345 - 430 = 135 - 120 = 15
```
Output: 15

b.
```
word=['P','R','O','G','R','A','M']
print(word[-4:]) # ['G', 'R', 'A', 'M']
print(word[::-2]) # ['M', 'R', 'O', 'P']
```

c.
```
word=['P','R','O','G','R','A','M']
print(word.count('R')) # 2
print(word.index('R')) # 1
```

d.
```
L=[1,2,3]
L*=3
print(L) # [1, 2, 3, 1, 2, 3, 1, 2, 3]
```

e.
```
list1=[10,20]
list2=[30,40]
list1.append(25)
print(list1) # [10, 20, 25]
list1.extend(list2)
print(list1) # [10, 20, 25, 30, 40]
```