Class IX

Answer Key

Artificial Intelligence

Part-B: Subject Specific Skills

1. Introduction to AI

Ai Task (Page 146)

1. Accept all relevant answers.
2. By 2030, AI will replace most number of jobs that are done by Human like for example most of the cleaning jobs will be done by Robots. There will be Bots, AI enabled that will be dealing with people with stress – CBT.
3. Computers can do tasks that are repetitive like large statistical calculations, better than humans.

Ai Task (Page 147)

Accept all relevant answers.

Ai Reboot (Page 149)

a. Yes b. No c. No d. Yes e. Yes

Ai Task (Page 151)

Accept all relevant answers.

Ai Reboot (Page 158)

Google Image Search – Computer Vision

Akinator – Data

Face-Recognition System in Mobile – Computer Vision

Cortana – Natural Language Processing

Video Session (Page 159)

Accept all relevant answers.

Ai Task (Page 159)

Mobile phones, smart watches, Alexa, smart TV, smart lights and all gadgets that are centrally connected in a smart house. For example, your phone calendar, disables the security systems as soon as you enter the house. It enables the security system when you proceed for vacations. All electronic gadgets switch on their power saving mode.

Video Session (Page 161)

Accept all relevant answers.

AI Task (Page 162)

1. Device Name: AI Energy Mode, a power feature from Samsung's Smart Things Energy.

   It is powered to bring the office in a power saving mode whenever it is not in use. Impressive savings in energy and cost have been recorded across the board.

2. Attendance: Face scanner to mark the attendance

   Name of Device/Software – Lystface.

   Its a facial recognition attendance management solution that works in real time. It's an android based facial attendance system.

AI Task (Page 163)

1. Attendance System: The RFID system card should be installed to track the students. The advantage is that the efforts of the teachers can be reduced and the student can be tracked.
2. Jukebox-Music in Bathrooms: washroom jobs can be noise free if the music is playing.
3. Entries to labs with IRIS – entry system – No unauthorised student can use the facilities if the timetable is not allocated.
4. Autonomous Timetable system: No delay in arrangement for the absent teachers can be covered effectively.

Video Session (Page 164)

Accept all relevant answers.

AI Reboot (Page 167)

1. Climate Action
2. Partnership for the Goals
3. No Poverty
4. Quality Education
5. Sustainable Cities and Communities
6. Responsible Consumption and Production
7. Life on Land
8. Clean Water and Sanitation
9. Decent Work and Economic Growth

AI Task (Page 168)

1. Rainwater Harvesting.
2. Discarded water from RO water coolers are collected and distributed to the washrooms.
3. Solar Panels for lights.
4. No single use Plastic Zone.
5. Discharged water from AC is diverted to the plants.

AI Task (Page 179)

36, 49, 64, 81, 100

IMPRINT 1

Ai Reboot (Page 182)

1. Niramai Health Analytix
2. Haptik.ai
3. Kissan AI

Ai Task (Page 182)

Our society is a combination of good and bad right and wrong, ethical and unethical, useful and useless. How we want to use AI in our society and what precedence we want to set for our future generations is what we need to decide today, as AI is expected to understand as more than what we know about ourselves in the future.

1. Talks at the level of National heads will be done.
2. Online security team will be alerted.
3. Necessary tracking of data/call would be done.
4. Peace talks and exchange of data will be done at the level of country heads.

Ai Task (Page 184)

Sr. No.	App Name	Ethical or Privacy Concern
1.	**Yono Bank:** SBI Bank app	No
2.	**Practo:** Doc's appointment app	Yes
3.	**Country Delight:** Milk product delivery app	No
4.	**Instagram:** Social Media	Yes
5.	**Facebook:** Social Media	Yes
6.	**Google Maps:** Maps	Yes
7.	**Whatsapp:** Communication	Yes
8.	**Ola:** Cab booking app	Yes
9.	**AccuWeather:** Weather Forecast	Yes
10	**Zoom:** Online meeting	No

Ai Task (Page 186)

1. Parking Entry
2. Registration in Hospitals
3. Banks: Withdrawal and Deposit
4. Security checks
5. Restaurants: To take orders

Ai Task (Page 187)

1. Do yourself
2. Job Advertisement

   Post: Autonomous Car Mechanic

Requirements: B.Tech – Mechanics
Male/Female
Minimum 2 years' experience

Maximum age: 45 years

Salary: $10,000 Bitcoins

Job Description:

1. Autonomous cars will drive themselves but they won't repair themselves. Require mechanics who will care for cars – will combine an old fashioned love of tinkering with a cutting edge understanding of technology.
2. You will be responsible for managing of inventory and availability of parts all time.
3. You will manage the helpers and guide them about the usage of any new part that come

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

AI Quiz

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

12. **(This question has been printed incorrectly in the book. Kindly update the question your textbook.)**

Match column A with Column B **[CBSE Sample Paper 2022]**

Column A		Column B	
1.	Expert System	A.	Simulate how a human would behave as a conversational partner.
2.	Chatbot	B.	Uses knowledge stored in a knowledge base but requires the intervention of human expert.
3.	Digital Assistant	C.	Autonomous vehicle
4.	self-driving car	D.	Works on various mobile platforms

a. 1 → B; 2 → A; 3 → D; 4 → C
b. 1 → A; 2 → B; 3 → C; 4 → D
c. 1 → D; 2 → A; 3 → B; 4 → C
d. 1 → C; 2 → A; 3 → D; 4 → B

Ans. a

13. a

B.

1. Precision	2. Affordable, skilled engineers	3. Hanson Robotics
4. Analysis, Prediction	5. Surveillance	6. Justice
7. Coding	8. Healthcare, Construction	9. Data Science
10. HDFC	11. Big Data	12. data

C.

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

SECTION B (Subjective Type Questions)

A.

1. Some applications of CV in AI are facial lock in smartphones, unusual behaviour detection, object classification, etc.
2. Areas where AI has made a remarkable impact are:
   a. Security surveillance b. Education c. Space exploration
3. The main focus of AI would be to replace humans in hazardous jobs. Fields like medicine, industry, environment, defence, wherever humans are vulnerable, it will be replaced with machines with human-like intelligence.
4. Data is a domain of AI that is related to input to the AI machine. AI requires large amounts of data to find the latest trends and patterns. More the data, the better will be the analysis and more accurate would be the prediction.
5. The main goal of smart cities is to optimise the economic growth of the city and improve quality of life for people with the use of technology and data analysis.
6. Smart Homes are homes that use internet connected devices to empower remote monitoring and management of appliances and devices such as for lighting and heating.
7. The goal of this SDG is to end hunger, achieve food security, improve nutrition and promote sustainable agriculture. It also aims to seek sustainable solutions to end hunger in all its forms by 2030 and to achieve food security.
8. A Sustainable Smart City is a city that use technology to provide services and better citizen welfare. It uses Information and Communication Technology (ICT) to communicate, deliver welfare schemes, improve operational efficiency and better quality of government services. The main goal of smart cities is to optimise the economic growth of the city and improve the quality of life for people with the use of technology and data analysis
9. LaMDA is the latest breakthrough in natural language understanding. It's a language model for dialogue applications and its open domain, which means its design to converse on any open-end topic.
10. Astronomers used AI to sift through years of data obtained by the Kepler telescope to identify a distant eight-planet solar system. AI is also being used for NASA's next mission to Mars, the AEGIS— a Mars based AI robot, already on the planet is responsible to handle autonomous targeting of cameras in order to perform investigations in Mars.

11. With rapid development of AI, the fear of unemployment is constant. Jobs in manufacturing, agriculture, food service, retail, transportation and logistics, and hospitality are some of the industries likely to be affected. The majority of the repetitive tasks would be taken over by AI.
12. One of the benefits of AI for business is that it handles repetitive tasks across an organization so that employees can focus on creative solutions, complex problem solving, and impactful work.
13. Artificial Intelligence (AI) is a branch of computer science that simulates human intelligence into machines, especially in computer systems, so that they can think and perform actions similar to humans.
14. Accept all relevant answers.

B. 1. General AI: It is also termed as Strong AI. Machines with the following characteristics will fall in this category. Machines that would perform a wider range of different tasks with the intelligence like that of humans. It is a step ahead of Weak AI by including problem-solving, learning and development.

Strong AI: At present, we have not developed any such machines.

Worldwide research is now focused on developing machines with strong AI. As these systems are in their research stage, it may take a lot of time and effort to develop these.

An example of Strong AI could be a machine hearing "good morning" and deciding to turn on the coffee maker.

Artificial Super AI-

Super AIs are in their hypothetical stage. Super AI systems would surpass the human intelligence in performing any task will fall in the category of Super AI.

Super AI will be able to understand humans and will be able to evoke their own emotions and desires as well. It can be considered as the next stage of Strong AI and developing such machines will be a challenging task.

2. a. Big Data Engineer: The role of a Big Data Engineer is to create an ecosystem for the business systems to interact efficiently. Their primary task is to build and effectively administer big data of an organization. They also have to carry out the function of obtaining outcomes from big data in a robust manner.

b. Machine Learning Engineer: Machine learning engineers are involved in building and maintaining self-running software that facilitates machine learning initiatives. They are in continuous demand by the companies and their position rarely remains vacant. They work with huge chunks of data and possess extraordinary data management traits.

c. Robotics Scientist: A reduction in jobs will indeed take place due to the emergence of robotics in the field of AI. Conversely, jobs will also rise as robotics scientists are in incessant demands by major industries for programming their machines.

3. The following are some of the advantages of smart homes:

It's convenient to manage all the devices from a single application.

Smart devices can maximise house security. Home automation systems can be connected to surveillance cameras, automated door locks, motion detectors for increased security.

With smart devices there's a flexibility of adding new devices with ease.

The applications give an insight to your home activities. You can keep a watch on the number of hours you watch television, the hottest hour of the day, energy consumption, control of heating and cooling, etc.

Remote control of household appliances can be a convenience on a busy day. You can switch on the air conditioner before reaching home, check if the lights are switched off, control the temperature of your oven, etc.

4. We use our vision to sense and identify objects around us. In the same way, AI machines use Computer Vision domain to understand their surroundings. Computer Vision (CV) is the domain of Artificial Intelligence that is used to train computers to read, process and analyse visual data in the same way as humans do. The type of data in CV is images and videos. The AI machine collects data from digital images and videos, and then process the data to identify the objects in the image/video. For example, a self-driven car scans the live objects like traffic signal, analyse the scanned image and then creates the 3D version of it. After that, the car decides whether to run or stop. Some other applications of CV in AI are facial lock in smartphones, unusual behaviour detection, object classification, home security systems, office security systems and drone-based surveillance systems.
5. Smart Cities are cities that uses technology to provide services and better citizen welfare.
   - It uses Information and Communication Technology (ICT) to communicate, deliver welfare schemes, improve operational efficiency and better quality of government services.
   - The main goal of smart cities is to optimise the economic growth of the city and improve the quality of life for people with the use of technology and data analysis.
   - Lights that adapt to daylight make smart street lights. Parking sensors to intimate about available parking lots, automated garbage collection are a few examples of a smart city. *The main characteristic of smart cities is to create an inclusive and sustainable environment that is centred around people's wellbeing.
6. A smart school is a technology-based teaching-learning environment for both teachers and students. ICT is used to achieve smart schools' educational objectives, prepare child friendly curriculum, assessment and teaching-learning mechanism. Children are prepared to be part of the Information Age:
   - Use of digital devices like laptops, tablets instead of conventional books. No longer students have to carry big bags for those books. All the subjects can be learned, stored, sorted on a single device.
   - Easy access to information on the internet is available not only to students but it is a benefit for the teachers as well. They can learn beyond the books using smart boards.

* A teaching environment becomes very interactive with the use of technology. Means of communication is better, one can connect to peers outside the classroom online. Even the teacher-student bond has improved with technology as the time gap of request and response is reduced.

7. **Goal 14: Life Below Water**

   Conserve and sustainably use the oceans, seas and marine resources for sustainable development. It aims to reduce water pollution, protect and restore ecosystems, sustainable fishing, conserve coastal and marine areas, reduce ocean acidification, end subsidies aiming to reduce overfishing and increase the economic benefits from sustainable use of marine resources.

   Goal 15: Life On Land

   Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, and combat desertification. It aims to conserve ecosystems, end deforestation, protect biodiversity and natural habitats, eliminating poaching and trafficking of endangered species.

8. The development of autonomous vehicles will revolutionaries the transportation system. Waymo, after many test drives, launched their first public riding services. Waymo's AI software crunches data from vehicles lidar, camera, GPS and cloud services to produce control signals that operate the driver-less vehicle.

9. a. **Healthcare for Assisting Doctors:** For saving human lives the medical industry is relying on AI on many fronts. Healthcare organisations are using IBM Watson for medical diagnosis. Google's DeepMind has successfully developed a system that can analyse retinal scans and spot symptoms of sight-threatening eye diseases.

   b. **AI in Education for Automated Grading System:** AI in the assessment process provides real-time learning feedback to teachers and students. Through Machine Learning and data analysis using AI, human patterns of data are studied. This helps in a quick and fair grading system without human interventions.

   c. **AI in Agriculture:** The world will need to produce 50 percent more food by 2050 as we are exhausting our resources. The only way this can be possible is when we are using it more wisely. AI can help farmers to get more from the land, and use resources more sustainably.

10. Email Spam Filters: Email categorization and spam filters are one of the powering features of AI that affect our inbox. Simple rule-based filters are used to mark spam or put email into various categories as Primary, Social, Promotion or Important.

11. a. Manufacturing and pharmaceutical work

    b. Doctors

    c. Soldiers

12. **Some of the sources of AI Bias are:**

    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, that most of them were men, so it favoured men over women.

Algorithms: The algorithms in itself do not add biasness to an AI model, but it amplifies the biasness. Let's see an example of an image classifier model. Its 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 the accuracy. Therefore, an AI algorithm may decide that the people in the kitchen are women despite the fact some of the images are of men.

Developers: The last source of AI bias is developers. Those who design AI models focus on achieving the desired goals. On that path at times, the biases of the developers are reflected in their models. It's important to note here that the ethics and AI bias are not the problems of the machine but the humans behind the machines.

C. Competency-based/Application-based questions:

1. Metadata collected from the user's history and interactions.
2. Vikram can install an application that provides augmented reality (AR) features and various filters to enhance and customize images are:
   - PhotoDirector
   - YouCam Perfect
   - PixIr
   - PicsArt
   - Snapseed
   - Adobe Photoshop Camera
3. a. Disadvantages of AI are:

   The disadvantages are things like costly implementation, potential human job loss, and lack of emotion and creativity.

   b. AI is now perfect in performing routine jobs so such non-creative jobs will inevitably vanish soon. AI has the potential to increase productivity, create new jobs, and raise living standards. However, by its very nature of performing "non-routine" tasks formerly thought to be strictly the domain of humans, AI is likely to disrupt large swaths of jobs and tasks.

   c. These could include data detectives or scientists, prompt engineers, robotics engineers, machine managers, and programmers, particularly those who can code in Python which is key for AI development.

d. Although lives of people do not improve if they keep on being unskilled. Unskilled people will have difficulties in growth and personal development.

e. No, AI should not replace laborious jobs completely as if it replaces laborious jobs completely, then there will be no source of income for the daily wage workers due to unemployment. So, industry owners can use some machines but more of manpower keeping in mind the growing world population

4. d
5. a

AI In Life (Page 199)

Accept all relevant answers.

AI Deep Thinking (Page 200)

1. AI as evil:
   - Too much Personal information captured and stored by the apps.
   - Data leakage.
   - No-Ethics of the machines
   - Biasness of the technology
2. Letter to Future Self

   Dear Amit,

   It's been so long that we heard from you that your life is healthy.

   Last that we heard from you was the new harvest of organic vegetables that you grew in your balcony. How's your new lenses in your eyes now? Hoping that the need for spectacles is not there. The pacemaker machine is serviced properly? What about your diabetes. I hope the new clip inserted in your palm is able to give you exact dosage of insulin.

   How`s your cleaner robot? How often do you need to get it serviced? Hope your VR-Pet Drone is also doing well!

   Look after yourself well. Update your medical details in the chip inserted.

   Take care

   With love

   Self
3. People changing their career one AI takes over:
   - Planners: Now building/offices can be designed using software.
   - Reduced Bank employees.
   - HR managers
   - Telemarketing

IMPRINT 1

- Book keeping clerks
- Computer Support specialists
- Advertising Sales people
- Receptionists
- Proofreaders
- Market Research Analysts

Ai Ready 1

1. Yes, I agree that the development in the field of artificial intelligence (AI) may lead to ethical issues. It's clear that while AI technology can bring many benefits, there are also concerns about how it might be used and the impact it could have on society.

   One ethical concern is related to the use of AI in decision-making. If AI systems make decisions that affect people's lives, there's a risk of bias or unfairness in those decisions. Additionally, issues such as privacy, job displacement, and the potential misuse of AI for harmful purposes are also areas of ethical concern.

   It's essential for developers, policymakers, and society as a whole to consider these ethical implications and work towards creating AI systems that are fair, transparent, and respectful of human values. This way, the positive aspects of AI can be harnessed while minimizing potential ethical challenges.

2. The main objective of developing AI systems is not necessarily to make them unpredictable and emotional like humans. While it's true that humans are unpredictable and emotional, the goal of AI is often to perform tasks efficiently and accurately.

   Making AI systems unpredictable and emotional might not be a good idea because it could lead to challenges in understanding and controlling their behavior. Unpredictability and emotions in AI could make it difficult for humans to trust and work with these systems. Instead, the focus is on creating AI systems that can understand and respond to human emotions or behaviors appropriately, but without necessarily replicating them.

   The aim is to develop AI systems that are intelligent and helpful in specific tasks while maintaining predictability and reliability.

3. Achieving the goal of Smart Cities may be more challenging without Smart Homes. Smart Cities aim to use technology to improve the quality of life for people in urban areas. Smart Homes, which are equipped with connected devices and technology, play a role in this goal.

   Smart Homes can contribute to Smart Cities by providing data and information that helps in managing resources more efficiently. For example, if homes are equipped with smart energy systems, it can contribute to overall energy efficiency in the city. Additionally, interconnected homes can enhance communication and coordination within a city, leading to better urban planning and services.

Therefore, while it might be possible to make progress toward Smart Cities without Smart Homes, the full potential of a Smart City may be better realized when homes are also integrated into the technological ecosystem.

4. Yes, I agree that we should limit the use of smartphones because various apps can collect and misuse our data. It's important to be cautious about how we use our smartphones because some apps may gather personal information without our knowledge. This data can be misused, and it's crucial to protect our privacy.

   Limiting smartphone use helps us control the amount of information we share with apps. By being mindful of the apps we download and granting permissions carefully, we can reduce the risk of our data being collected and misused. It's important to prioritize our privacy and take steps to ensure that our personal information is not exploited.

   In conclusion, limiting smartphone use is a sensible approach to safeguarding our privacy and preventing potential misuse of our data by various apps.

2. AI Project Cycle

Ai Reboot (Page 212)

1. Problem Scoping
2. Data Acquisition
3. Data Exploration
4. Modelling
5. Evaluation

Ai Task (Page 212)

1. List of people who have access to the flight, that is passenger maintenance and engineering staff associated with the flight, crew members of flight, flight officials having access to the flight.
2. Criminals who have explicitly shown interest in his escape on any media.
3. Background of the criminal, and who have been his associates in crime and have still not been captured.
4. Background of the security team accompanying the criminal.
5. Flight stop-overs, and who all can have access to the flight at the time of stop-over and the duration of the flight. List of components of your system to detect unauthorised access are as follows:

   a. face scanner like BioNIC F7

   b. Database management system like to store images like MongoDB

   c. Facial security cameras for entry places other than main door of the Aircraft

   We test algorithms to find out which algorithm, out of our shortlisted ones, produces most accurate results, when different combination of people are sent in front of the camera in the aircraft for testing.

Ai Task (Page 218)

Do yourself

Ai Task (Page 220)

Data features needed

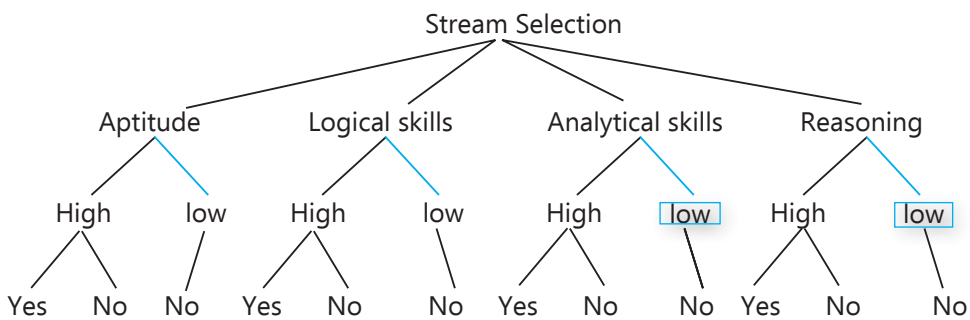
1. Names of the participating restaurants
2. Categories of food for study
3. Amount of average food wasted on daily basis under each category.
4. Average losses due to each food category.
   - Features collected will let us know where to act in order to solve the problem.
   - We can collect the data from the restaurants
   - Data can be collected on weekly basis
   - Without enough data we wont be able to make out correct analysis and wont be able to find out solutions for reducing food wastage.
   - It is required that a restaurant should know what material it should buy in lesser quantity to reduce wastage.
   - By deploying solutions for few weeks and monitoring improvement.
   - Analysis provides aground for the solutions to be taken.

Ai Reboot (Page 222)

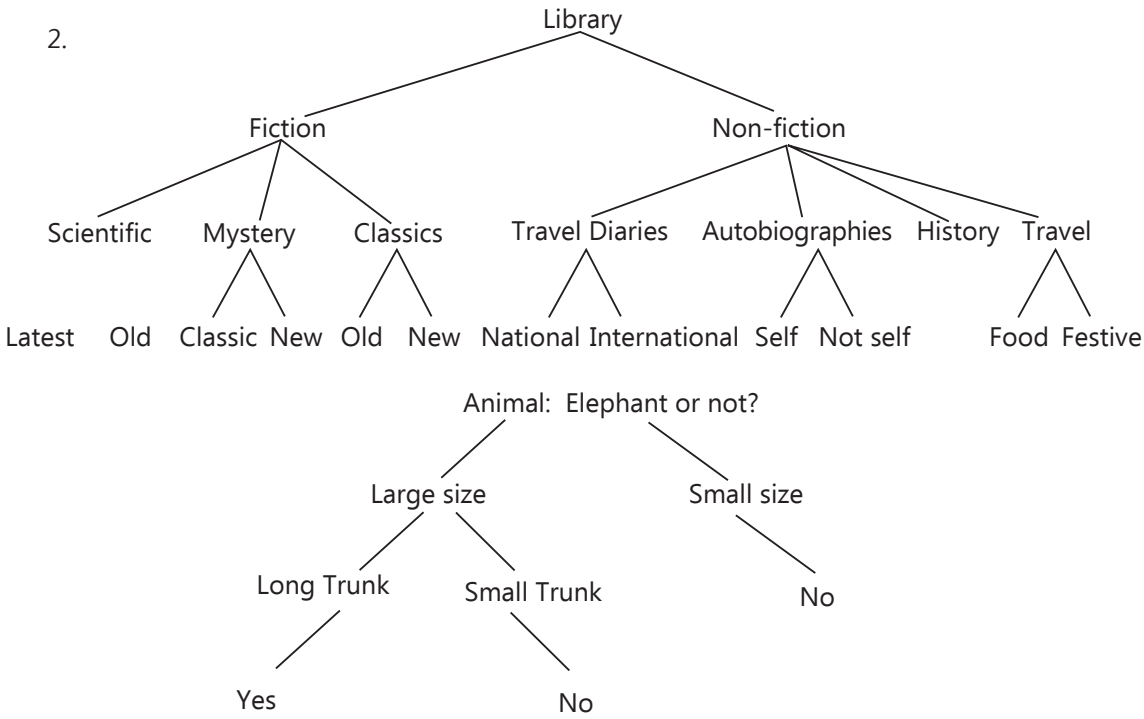
1. Surveys
2. Web scraping
3. Sensors
4. Cameras
5. Observations

Ai Task (Page 236)

1.



2.



Ai Task (Page 237)

Accept all relevant answers.

Video Session (Page 239)

Accept all relevant answers.

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

Ai Quiz

A. 1. b 2. c 3. a 4. d 5. a 6. a
7. c 8. b 9. d 10. a 11. d 12. b
13. c 14. d 15. b 16. d 17. a

B. 1. AI project cycle 2. Evaluation 3. Data Exploration 4. Solution
5. Testing data 6. elements, interconnections 7. Cameras
8. System maps 9. Data visualisation 10. Unstructured data
11. Pie 12. Decision tree 13. Rule-based 14. Accuracy 15. Pixel

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

7. False 8. True 9. False 10. False 11. True 12. False
13. True 14. True 15. False

SECTION B (Subjective Type Questions)

A. 1. AI project cycle is the process of converting the real-life problem into an AI-based model. The project cycle framework is designed to help project managers guide their projects successfully from start to end. The purpose of the project life cycle is to create an easy-to-follow framework to guide projects and leads us towards our goals.

2. Modelling or data modelling is defined as the process of designing decision-making algorithms that has to be trained on a set of data (which was acquired at the data acquisition stage for the problem you scoped in the problem scoping stage) and apply that learning to recognize certain types of patterns.

3. AI Project Cycle has 5 stages:
   a. Problem Scoping b. Data Acquisition c. Data Exploration
   d. Modelling e. Evaluation

4. There are two types of data:

   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. Data can be collected from various sensors like collecting environmental data and stored in some data storage solutions. Sensors are connected through gateways which enable them to collect live data in the offline mode.

6. There are times using the internet, we acquire unauthentic data from websites for our AI project. Extracting private data can be an offence.

   So, keeping this in mind we should ensure the data is collected from open-sourced websites hosted by the government. They are one of the most reliable and authentic sources of information.

7. (This question was printed incorrectly in the book, please correct it in your textbook.)

   Question: What is root node in a decision tree?

   Ans. A root node is the first node of a decision tree and it represents the entire set of data.

8. Data is the base for any AI project to be built. When the data is acquired, it's important to check if it's from a reliable and authentic source for the accuracy of the project.

9. It is a data visualisation tool provided by Microsoft. It is freely available to download and use.

10. It is a combination of a bubble chart, data visualization and a map. It is used to visualize location and proportion using circles over geographical regions with the area of the circle being proportional to its value in the dataset.

11. (This question was printed incorrectly in the book, please correct it in your textbook.)

    Questions: What is child node?

    Ans. A sub-node in a decision tree that falls under another node.

12. Pixel It is an example of a machine learning approach which is used in computer vision applications. The graphics or images created in computers are pixel-based images. It shows how the computer classifies the images and reads them.

13. Learning based approach refers to the model where the relationship or patterns in the data are not defined by the developer. Random data is fed into the machine and the machine develops its own pattern or trends based on data outputs.

14. (This question was printed incorrectly in the book, please correct it in your textbook.)

    Questions: What is web scrapping?

    Ans. Web scraping or Data scraping is the method of downloading information from the World Wide Web (WWW) and storing it onto your computer for later reference.

15. Machine learning aims at making a machine that can learn through data and solve complex problems. Deep learning aims at building neural network that can help in discovering patterns or trends.

B. 1. AI project cycle is the process of converting the real-life problem into an AI based model. The project cycle framework is designed to help project managers guide their projects successfully from start to end. The purpose of the project life cycle is to create an easy-to-follow framework to guide projects. The AI project cycle provides us with an appropriate framework which can lead us towards our goal.

   a. **Problem Scoping:** The first stage of an AI project cycle is problem scoping to identify the problem and have a vision to solve it. Problem scoping means selecting a problem and finding a solution for it using AI technology. The project identifies the area in which AI can be used to provide a solution.

      Many times we are unable to observe any problem in our surroundings. In that case, we can take a look at the Sustainable Development Goals. 17 goals have been announced by the United Nations which are termed as the Sustainable Development Goals. The aim is to achieve these goals by the end of 2030.

   b. **Modelling:** It is the design phase of the project cycle. In this, we select the best way to reach the solution. It requires the process of selecting the right algorithm to develop a working model for the project. In this step, the algorithm is converted into a model.

   c. **Data Acquisition:** The term data acquisition means collecting raw data for the purpose of reference or analysis for the project. The data can be in the form of text, numbers, images, videos or audio. The data acquisition system allows us to obtain valuable information about reality to improve the performance of the project.

2.

Our	MIIT officials	Who?
Have a problem of	Conducting an examination	What?
While	No unfair means should be used in the examination or no unauthorized person should enter the examination center	Where?
An ideal solution would	A system which can check who all are entering the center, and the system should raise an alert if it finds any unauthorized person entering so that they have fair admission selection.	Why?

3.

Our	IT company	Who?
Have a problem of	Categorising support tickets	What?
While	In operations where they are not able to classify support tickets properly which leads to delay in response	Where?
An ideal solution would	A classification system which can categorise the support tickets correctly and in less time	Why?

4. A system map is a diagrammatic representation of a set of things working together. It focuses on the components and boundaries of a system. System map helps us to find relationships between different elements of the problem which we have scoped. It helps to find a solution to achieve the goal of our project. We use system maps to understand the complex issues that have inter connected factors affecting each other.
5. We use system maps to understand the complex issues that have inter connected factors affecting each other. A system comprises of:
   a. **Elements:** These are different, discrete elements within the system.
   b. **Interconnections:** These are the relationships that connect the elements.

   Rules for system maps are:
   a. The circles represent elements.
   b. Arrows are used to represent relationships/interconnections.
   c. The '+' and '-' signs are indicators of the nature of a relationship. The arrowhead depicts the direction of the effect and the sign (+ or -) shows their relationship.
   d. If the arrow goes from X to Y with a + sign, it means that both are directly related to each other. That means if X increases, Y also increases and vice versa.
   e. If the arrow goes from X to Y with a -sign, it means that both the elements are inversely related to each other. That means if X increases, Y would decrease and vice versa.

6. There are various sources to collect relevant data for our project:
   a. Surveys: Data can be collected from online surveys, telephonic surveys or in person surveys and collect responses. Surveys are a way of collecting data from a group of people in order to gain information and insights into various topics of interest. The process involves asking people for information through questionnaires which can be online or offline. It can be considered as a data source.
   b. Web Scraping: Data or information can also be extracted from a website.

      Web scraping or Data scraping is the method of downloading information from the World Wide Web (WWW) and storing it onto your computer for later reference. The data collected in this way is an online data.
   c. **Sensors:** Data can also be collected from various sensors like collecting environmental data and stored in some data storage solutions. Sensors are connected through gateways which enable them to collect live data in the offline mode.
   d. **Cameras:** Data can be seen, written down or recorded onto the computer. Cameras are used to collect data in the form of images. CCTV, web cameras, surveillance cameras are big sources of visual data that can be acquired from various places.
   e. **Observations:** It is a method of collecting data by watching facts as they occur. Using the observation technique data can be analysed and used for testing the model.
   f. **Application Programming Interface (APIs):** APIs are a set of functions and procedures that allow one application to connect to another. So, one of the ways of collecting data is through APIs that can be used to collect data from social media services for analysis.
7. Data exploration refers to the techniques and tools used to visualize data through complex statistical methods. It is the process of analyzing a large data set.

   Data exploration means to find the patterns and trends in the data. It is the third stage in the AI project cycle and the initial step in data analysis. It is used to understand what is in a dataset and the characteristics of the data.

   Data exploration cleans the big data to provide an input to an AI project. Terabytes of data sitting in the data centre unused is a burden, if correctly processed it can become digital gold.
8. Here are 10 elements of good data visualization that can help you present information that readers can process quickly and easily.
   - Clear Headings and Keys.
   - Simple Analysis.
   - Lots of Data/Evidence.
   - Add design elements.
   - Obvious Trends.
   - Relevant Comparisons.
   - Summaries of Key Points.
   - Consolidated Information.

9.

Artificial Intelligence	Machine Learning
AI aims at making a machine that mimics human intelligence.	Aims at making a machine that can learn through data and solve complex problems.
It is a subset of data science.	It is a subset of AI.
It is the simulation of intelligence in machines.	It is the training of machines to take decisions with experience.

10. Following are some of the important points to consider while designing a decision tree:
    - There can be a possibility of multiple decision trees which lead to correct prediction for a single dataset. The simplest one should be chosen.
    - The dataset might contain redundant data at times, which does not have any reference while creating a decision tree. Therefore, it is necessary that only those parameters that affect the output directly should be included.
    - While making Decision Trees, one should take a look at the dataset given to them and try to figure out what pattern does the output leaf follow. Try selecting any one output and on its basis, find out the common links which all the similar outputs have.
11. Decision trees are tools that follow a rule based approach that uses a tree-like model of decisions and their possible consequences. It is a kind of flow chart, where the flow starts at the root node and ends with a decision made at the leaves. It is used to depict conditions and their outcomes. It is one of the most widely used and practical methods for supervised learning.

    The decision tree starts from the **root node** just like the structure of a tree with two different ways or conditions: Yes or No. The forks or diversions are known as **Branches** of the tree. The branches either lead to another **decision/ question node** or they lead to another condition for decision, which is known as **leaf node**. If you look closely at the image, it looks like an inverted tree with roots above and leaves below
12. **Machine Learning:** Machines need to learn the ways of humans by learning the techniques and processes. So machine learning is a subset of artificial intelligence that uses statistical methods that enable machines to improve with experiences. So machines learn from their mistakes and take them into consideration in the next iteration, this way they keep improving with experience. For example, Snapchat filters and Netflix recommendations.

C. Competency-based/Application-based questions:

1.

Our	prestigious Institute	who
Has a problem that	For years the ratio use to be 70% Boys and 30% Girls. The shift increased in both to 50% Boys and 50% Girls last year. This year all of a sudden the ratio changed to 70% Girls and 30% Boys. Now they have no more space to adjust these many girls.	what
when /while	For years the ratio used to be 70% Boys and 30% Girls. The increase in Girls was moving at a slow pace and it took 5 years to reach 50% Boys and 50% Girls last year. Seeing the change in ratio, the Institute has been creating more space for girls, with girls passing out and who are joining in. This year all of a sudden the ratio changed to 70% Girls and 30% Boys. The girls hostel did not have space to adjust this unprecedented number.	where
An ideal solution would be	An ideal solution to this problem would be expanding the girls hostel so that the institute can accommodate more girls. Accepting an equal amount of girls and boys so as to maintain a ratio and not face any problems when it comes to accommodation.	why

2.

Our	Differently abled people and people who cannot see but can hear and speak	who
Has a problem that	differently abled and need assistance in ordering meals from the menu. There are people who cannot see but can hear and speak, and they should be able to order in a restaurant the meal of their choice.	what
when /while	Everyone loves to eat out once in a while. But when we talk about inclusiveness everyone doesn't get the same freedom to order at the restaurant what they want.	where
An ideal solution would be	For differently abled people, we can start by having more inclusive menus. For people who cant see, menus written in braille can be provided. For people who can't hear or speak, hiring sign language experts will help them order easily.	why

3. c 4. c 5. d 6. c

Δi In Life (Page 250)

Accept all relevant answers.

Δi Deep Thinking (Page 250)

1. • **Testing for real life scenarios:** Firstly, where it needs to be installed.
   • **Hurdle:** It will require lots of money and time to check for the efficiency in different scenarios.
   • Weather conditions will also play a key role.

Δi Ready 2

1. Accept all relevant answers.
2. Decision trees are tools that follow a rule based approach that uses a tree-like model of decisions and their possible consequences.

   We can create decision trees with the help of these points:

   i. There can be a possibility of multiple decision trees which lead to correct prediction for a single dataset. The simplest one should be chosen.

   ii. The dataset might contain redundant data at times, which does not have any reference while creating a decision tree. Therefore, it is necessary that only those parameters that affect the output directly should be included.

   iii. While making Decision Trees, one should take a look at the dataset given to them and try to figure out what pattern does the output leaf follow. Try selecting any one output and on its basis, find out the common links which all the similar outputs have.
3. Problem scoping is critical in the AI project cycle because it entails identifying a problem and then developing a strategy to solve it.
4. Accept all relevant answers.

3. Neural Networks

Δi Reboot (Page 256)

1. a. Facial recognition
   b. Forecasting
   c. Music Composition
2. Neural networks are trained to understand the patterns and detect the possibility of rainfall or rise in stock prices with high accuracy.

Ai Task (Page 257)

1. It is a systematic grouping of observations in categories, something like categorising plants, animals in different taxonomies by biologists. In classification, you teach the machine to perform with labelled data. Testing data is then classified as one of the labels of the training dataset.
2. The labelled data is used for easy and clear gouping of data for classification.

Video Session (Page 260)

Accept all relevant answers.

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

Ai Quiz

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

B. 1. Deep learning 2. Sensory 3. Datasets 4. Neurons 5. Electrical

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

D. 1. d 2. b

3. e (mapping function) (This is misprinted in your book, please correct it)

4. a 5. c

SECTION B (Subjective Type Questions)

A. 1. The three advantages of neural networks are:
   - Parallel processing capability
   - Data is stored on the entire network
   - Capable of learning from non-linear and complex data

2. 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.
3. Neural networks are made up of layers of neurons, just like the human brain that consists of millions of neurons. These neurons are the core processing units of the network.
4. Neural network is the best tool for this type of AI model.
5. Facebook uses facial recognition powered by artificial neural networks to suggest to you whom you should tag in the post.
6. A neural network determines and does not require to be reprogrammed.

IMPRINT 1

B. 1. Just like the human brain where all neurons are interconnected to one another, artificial neural networks also have a large number of artificial neurons(nodes) that are interconnected to one another in a sequence of layers of the networks.

Dendrites in the human brain receive the impulse and pass on to the cell body of the neuron. From the cell body the impulse travels to the axon and passes to another neuron attached through a joint called synapses. This process goes on through a complex network of neurons to get the desired stimulus of the impulse.

Similarly, the artificial neurons(nodes) take input data and perform simple operations on the data. The result of these operations is passed to other artificial neurons(nodes) which are arranged in a sequence of layers.

2. There are three types of neurons in our body:
   a. Sensory neuron: It carries the sensory signals from sensory organs to the brain. It gets activated when you touch, smell, hear, see or feel something.
   b. Motor Neuron: It carries the signal from the brain or spinal cord to the organs, glands or muscles to carry out voluntary or involuntary movement.
   c. Interneuron: They connect the sensory and motor neurons to help in the transmission of signals and form a complex internal neuron network.
3. Following are the two AI models:
   - Regression is an example of rule-based AI models. This is a type of Rule Based AI model. In regression, the algorithm generates a mapping function from the given data, as shown by the solid line in the given graph. The blue 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. It works with continuous data.
   - Clustering is a machine learning approach where the machine partitions the dataset into different clusters or categories based on machine generated algorithms. The data fed to such a model is usually unlabeled or random and thus the developer feeds in the data directly into the machine and instructs it to build its own algorithm. The machine then forms a pattern or cluster based on training data and groups those that follow the same pattern. The best clustering is the one that minimizes the error. Clustering works on discrete dataset.
4. Classification is another rule-based AI model. It is a systematic grouping of observations in categories, something like categorising plants, animals in different taxonomies by biologists. In classification, you teach the machine to perform with labelled data. Testing data is then classified as one of the labels of the training dataset.
5. i. An ANN in its training phase is capable of learning by recognising patterns in data which is later used to generate the desired output.
   ii. ANN is the foundation of AI and is used to solve complex problems that are difficult for humans.

C. Competency-based/Application-based questions:

1. Machine Learning
2. a

Ai In Life (Page 269)

Accept all relevant answers.

Ai Deep Thinking (Page 269)

1. Facial Recognition
2. Stock Market Prediction
3. Social Media
4. Aerospace
5. Defence

For Report accept all relevant answers

Ai Ready 3

1. Accept all relevant answers.
2. (This question is printed incorrect in the text book. Correct this question in your text book.)

   Question: What is the difference between Artificial neural network and biological neural network?

   Ans. Artificial neural network is artificially created efficient computing systems designed to simulate the human brain. It includes machine learning as a part of artificial intelligence. An ANN in its training phase is capable of learning by recognising patterns in data which is later used to generate the desired output. ANN is made up of three basic layers—Input, Hidden and Output, whereas Biological neural network is composed of a group of chemically connected or functionally associated neurons. Neurons transmit electrical signals to other neurons. These neurons are the building blocks of the complete central nervous system of the living body. Brain is the control unit of this neural network.
3. The human brain is a "network" of 100 billion neurons, each of which is connected to thousands of other neurons, making a total of millions of connections within the brain, whereas one of the most common kind of neural network architecture is the simple three layers structure of artificial neurons.
4. The most impressive aspect of neural networks is that once trained, they learn on their own just like human brain.

4. Introduction to Python

Ai Task (Page 281)

Step 1 Buy bread and Vegetables

Step 2 Grate cucumber, Carrot.

Step 3 Mix Salt, Pepper to grated cucumber and carrot.

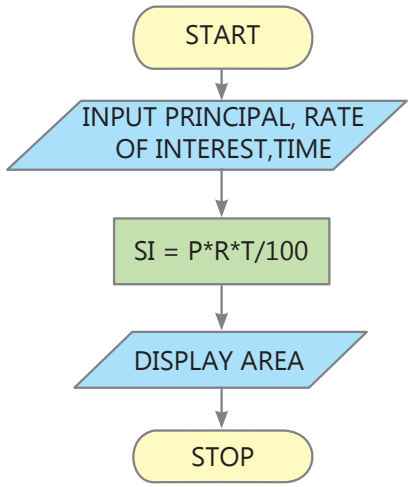
Step 4 Add Mayonnaise, Ketchup.

Step 5 Add mixture to the bread slices.

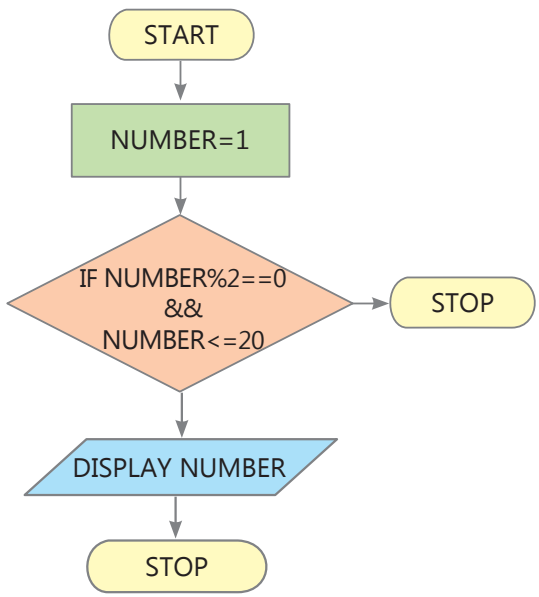
Step 6 Units the Sandwich.

Step 7 Eat

Ai Task (Page 283)



Ai Task (Page 285)



Ai Task (Page 295)

Accept all relevant answers.

Ai Reboot (Page 303)

1. This operator is used to represent and calculate exponents.
2. Relational operators or comparison operators compare the values given on both the side of the operators and returns the Boolean value either True or False.
3.
```
X = 2
Y = 5
X**= Y
```
Output: 32

Ai Task (Page 304)

1. 10 + 20 / 5 – 3 * 2
   = 10 + 4 – 6
   = 14 – 6
   = 8
2. 5 * (10 + 5) + 10 – 5
   = 5 * (15) + 10 – 5
   = 75 + 10 – 5
   = 85 – 5
   = 80

Ai Task (Page 309)

Accept all relevant answers.

Ai Task (Page 309)

```
r = int(input("Enter the radius of the circle: "))
Area = 3.14*r*r
Perimeter = 2*3.14*r
print("The area of the circle is: ", Area)
print("The perimeter of the circle is:", Perimeter)
```

Ai Task (Page 326)

1. ['N', 'I', 'A', 'U']
2. ['N']
3. ['E', 'D', 'U', 'C', 'A', 'T', 'I', 'O']

Unsolved Questions

SECTION A (Objective Type Questions)

Ai Quiz

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

B. 1. Algorithm 2. Algorithm, flowchart 3. Flowchart
4. Flowchart 5. Guido van Rossum, www.python.org
6. ==, += 7. ASCII 8. None 9. Python 10. condition
11. else 12. Traversing 13. Negative 14. Different 15. 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=y=10
a=int(input("enter number"))
print("number entered is",a)
a+=5
b=10
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. Program:

```
i = 1
while i < 5:
    print(i)
    i += 2
print("Python")
```

2. Program:

```
sum = 0
    for j in range(20,10,-2):
        sum += i
print(sum)
```

F. 1. 1022*1024*1026*1028*

2. 50

3. 0*2*4*

SECTION B (Subjective Type Questions)

A. 1. There are two coding programs:

CodeCombat: It is the company's original coding game recommended for parents, individuals, educators and students.

Ozaria: It is an adventure game, fantasy story, and Computer Science program recommended for educators and students.

2. Flowcharts are easier to understand than algorithms as they are represented in pictorial forms. One can easily write the code by looking at the flowchart.
3. Many different algorithms might be acceptable for each problem. Due to the flexibility of the English language, the same algorithm can often be expressed in more than one way. In addition, there is almost always more than one way to solve a problem.
4. The selection control structure allows one set of statements to be executed if a condition is true and another set of actions to be executed if a condition is false.
5. You will need to enclose it with a pair of Triple quotes, one at the start and second in the end. Anything inside the enclosing Triple quotes will become part of one multiline string.
6. The print() function prints the specified message to the screen, or other standard output device.
7. Variables are used to store information to be referenced and manipulated in a computer program. They also provide a way of labeling data with a descriptive name, so our programs can be understood more clearly by the reader and ourselves.
8. Floor division divides the first number with the second number and returns the whole number adjusted left to the number line whereas normal division just divides the two values.
9. You must follow the given rules while creating and naming the variables and constants?
    - Names should be descriptive and meaningful. Avoid using short names or single letters, unless the meaning is obvious. For example, "age" is a better name than "a".

- Variable names should be in lowercase, with words separated by underscores. For example, "first_name" is a better name than "firstName".
- Constant names should be in uppercase, with words separated by underscores. For example, "PI" is a better name than "pi".
- Avoid using reserved keywords as variable or constant names. Reserved keywords are words that have special meaning in Python, such as "if", "else", "for", "while", "class", etc.
- Use camel case for class names, with the first letter of each word capitalized. For example, "MyClass" is a better name than "myclass".
- Use descriptive names that reflect the purpose of the variable or constant. For example, "total_cost" is a better name than "x".

10. A sequential programming is when the algorithm to be solved consists of operations one after the other, where there are no sentences that are repeated or you do not have to do alternative operations. For example: The alarm sounds. You wake up. You brush your teeth.
11. A nested if statement is an if statement placed inside another if statement. Nested if statements are often used when you must test a combination of conditions before deciding on the proper action.
12. Step value is the value by which the counter variable is incremented or decremented every time the loop body is executed. It can be a positive or a negative value, but it cannot be zero. In case it is zero, the while loop will run infinitely.
13. This loop is also called an entry-controlled loop as it checks for the condition in the beginning only. If the condition is true then the body of the loop will be executed. If the condition is false then control of the program will not be allowed to enter within the loop and it stops.
14. This function sorts the list in ascending or descending order. This is done "in the list itself" and works for the list with values of the same data types.
15. **Features of Python:** Some features of Python are given the following:

    High-Level Language: Python is a high-level and general-purpose programming language which simplifies the process of developing a program. .

    Easy to Learn and Use: Python has simple English-like statements which are easy to learn and use. Anybody can easily get used to its syntax and can expertise in it.

    Expressive Language: Python supports simple code that expresses itself in a few lines to do big and complicated tasks.

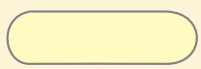
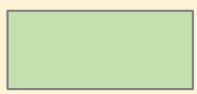
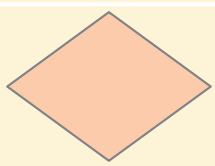
    Free and Open Source: Python code is developed under OSI-approved open-source license which allows it to be downloaded free of cost from its official website https://www.python.org.

    Cross Platform Language: Python supports multiple platforms like Windows, Linux, Mac, Raspberry, Pi, etc.
16. The remove( ) function removes the first occurrence of the element with the specified value. The pop( ) function removes an element from the list based on the index number specified in the function and returns the deleted value.
17. False

B. 1.

Algorithm	Flowchart
It is a step-by-step textual approach to solve a problem.	It is step-by-step visual/graphical approach to solve a problem.
It is a Pseudocode (false code) of a program.	It is a graphical representation of a program.
Difficult to represent branching and looping.	Easily represents branching and looping through symbols.
Easy to find errors.	Difficult to find errors.
Can be used for simple, complex or long processes.	Advisable to use only for simple processes.

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.
Diamond		Used for decision making in case of branching or looping.
Arrow in any direction		Used to show the direction of flow of information in a flowchart.

3. To solve this problem of writing a program we follow some steps as given below:
   a. Understanding the Problem: This is a very important and difficult step where we need to understand the main objective of a problem. Give more time to this step as the better you understand the problem, the easier it will be to solve it.

b. Analyzing the Problem: In this step, we analyse what kind of data can be given as an input, what formula or tool to use to do the processing and in which format the output will be displayed.

4. There are three different types of control structures Sequential flow, Selection flow and Repetition flow.

Sequential Flow

In sequential flow, the statements are placed one after the other and the flow of execution occurs starting from line1, line2 and so on with a top-down approach. It is the default flow followed in any programming language. For example, steps for calculating percentage of any student are:

a. Input marks of English Hindi and Math
b. Total the marks
c. Calculate the percentage
d. Display the percentage

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, if we consider the above example where we have a condition-award to be given if the percentage is more than 90 only.

a. Input marks of English Hindi and Math
b. Total the marks
c. Calculate the percentage
d. Display the percentage

If percentage is more than 90 then

Display "Award given"

Otherwise

Display "No award"

Repetition Flow

Repetition flow is also known as a loop as it 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 follow the concept of repetition.

a. Repeat for 10 people

- Input marks of English Hindi and Math
- Total the marks
- Calculate the percentage
- Display the percentage
- If percentage is more than 90 then

Display "Award given"

Otherwise

Display "No award"

b. Go up again till number of repeats is less than or equal to 10

5.

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	3 4.0
Multiplication	*	Multiplies two values.	2 * 3 1.5 * 2 "Hi" * 3	6 3.0 HiHiHi
Division	/	Divides two values.	4 / 2 6.0 / 2 6 / 2.0 11 / 2	2.0 3.0 3.0 5.5
Remainder	%	Returns the remainder of a division.	5 % 2 16 % 11	1 5
Exponential	**	Second number raised to the power of 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 proper understanding of the code in simple English statements. They are completely ignored by the Python interpreter.

There are two different ways of writing comments in Python.

- Single Line Comment
- Multiple Line Comments

7. Following are some number types:
   - **Integer:** Integers are whole numbers (+ve, -ve or 0) with no fractions or decimal value. Its length is dependent on the 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+2i where 3 is a real number and 2i is an imaginary number.
8. There are three kind of errors which a programmer encounters in Python— syntax error, logical error and runtime error.

   Syntax Error

   Syntax means writing the code following the rules of Python language. Syntax error is occurred when we violating the rules of Python language.

   This is the most common type of an error made by a programmer. If there is typing error, incorrect indentation, or incorrect arguments given in a function then Python will not be able to interpret the instruction and will raise a syntax error.

   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.

   Runtime Error

   Runtime error occurs during the execution of a program like wrong input or output errors, undefined object errors, division by zero errors. This type of error will halt the program execution unexpectedly.
9. The three programming constructs are:

   Sequential Statements

   A step-by-step process of execution of code is called sequential flow of control. This is the default flow of execution of a program. It means that the computer will run the code one line at a time starting from line 1, followed by line 2 and so on till it reaches the last line of the program.

   Selection Statements

   In Python, Selection flow of control is achieved through conditional statements. In the conditional/selection statements, flow of control is changed based on a condition. We specify the condition in the program which evaluates to either True or False.

If condition is True then the block of statement written for True will be executed and in case the condition is False then the block of statements for False will be executed.

Iterative Statements

In Python, the process of repeating a set of instructions based on a condition is called loop. There are two types of loops in Python— for loop and while loop.

10. Data Type Conversion: Data of one type can be converted into another type by using type conversion built-in functions like int(), float(), str(), etc. The process of converting value of one data type to another is called type conversion or type casting. For example,

```
>>> float(12)
12.0
>>> int(15.5)
15
>>> str(12)
'12'
>>> int(True)
1
>>> bool(0)
```

False

11. **The for Loop**

The for loop is used to repeat a set of instructions for a fixed number of times. It means the number of iterations are known/definite before we start with the execution of a 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.

The while loop

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. It is therefore known as indefinite loop. Indentation of statements is must to specify the block of statements to be repeated using while loop.

12. Using the range() Function: The range( ) function is an inbuilt function that is used to generate a set of values between the specified range.

```
for <Var> in range(<Start>, <End+1>, <Step>):
Statements
```

Where,

`for, in` and `range` are keywords.

`Start, End and Step` are parameters of `range()` function and will always be integers.

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`Start` is a starting value of loop and End is an ending value+1 of `loop`, `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` is a -ve integer should be given.

If `Start < End` then `Step` is a +ve integer.

If `Start >= End` and `Step` value is not specified then it assumes as +ve which is an invalid condition to run a loop so the loop will not execute at all.

13. In Python, the process of repeating a set of instructions based on a condition is called loop. There are two types of loops in Python— `for` loop and `while` loop.

The for Loop

The `for` loop is used to repeat a set of instructions for a fixed number of times. It means the number of iterations are known/definite before we start with the execution of a 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.

The while loop

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. It is therefore known as indefinite loop. Indentation of statements is must to specify the block of statements to be repeated using while loop.

14. The list has the following important features:
    - It is mutable data type.
    - It is an ordered sequence of values.
    - Each element is separated by comma and enclosed in square brackets [ ].
    - Each value/element is accessed by an index number.
    - The values can be added, modified or deleted by the user throughout the program.
    - It stores the values of different data types.

15. There are two different functions used to remove elements in an existing list `remove( )` and `pop( )`.

The remove( ) Function

The `remove( )` function removes the first occurrence of the element with the specified value. It means only one value can be removed at a time even if there are duplicate values in the list. If you wish to remove multiple values then this function can be used within a loop where it repeats itself a specific number of times.

The pop( ) Function

The `pop( )` function removes an element from the list based on the index number specified in the function and returns the deleted value. In case no index number is given then by

default it removes the last element from the list. If we try to remove an index number which does not exist then it gives an IndexError.

16. The * operator is used to replicate a list specific number of times. With * operator, one operand has to be a list and the other should only be an integer, otherwise it will give an error.

17. The elements of a list can be accessed by using its index number starts with 0 (zero). There are two different ways of using the index number:

    Forward Indexing: The index number begins with 0 till length-1 and we refer the elements from left to right.

    Negative/Backward Indexing: The index number begins with -1 till -length and we refer the elements from right to left.

C. 1. Program:

```
A=int(input("Enter the 1st angle= "))
B=int(input("Enter the 2nd angle= "))
C=int(input("Enter the 3rd angle= "))
S=A+B+C
if S==180:
    print("The angles form a triangle")
else:
    print("The angles do not form a triangle")
```

2. Program:

```
F = int(input("Enter the temperature in fahrenheit: "))
C = ((F / 5) * 5) - 32
print(F, "degree fahrenheit is equal to ", C, "celcius")
```

3. Program:

```
s=float(input("Enter the time in seconds: "))
m=s/60
print("The time in minutes is: ", m)
```

4. Program:

```
Radius = 5
area_of_the_circle = 22/7 * Radius * Radius
print ("Area: ", area_of_the_circle)
```

5. Program:

```
x = int(input("Enter the length: "))
y = int(input("Enter the breadth: "))
if(x==y):
```

```
    print("It's a square")
else:
   print("It's not a square")
```

6. Program:

```
weekday = int(input("Enter weekday day number (1-7) : "))
if weekday == 1 :
    print("\nMonday");
elif weekday == 2 :
    print("\nTuesday")
elif(weekday == 3) :
    print("\nWednesday")
elif(weekday == 4) :
    print("\nThursday")
elif(weekday == 5) :
    print("\nFriday")
elif(weekday == 6) :
    print("\nSaturday")
elif (weekday == 7) :
    print("\nSunday")
else :
    print("\nPlease enter weekday number between 1-7.")
```

7. Program:

```
bool_value = False
float_value = 15.6
result = bool_value and float_value
print(result)
```

8. Program:

```
Salary = int(input("Enter the salary of the employee: "))
Years_of_Service = int(input("Enter the number of service years: "))
Bonus = (Salary * 0.15)
Net_Salary = 0
if Years_of_Service > 5:
    Net_Salary = Salary + Bonus
print(Net_Salary)
```

9. Program:

```
string_value = "Zero"
bool_value = True
result = bool(string_value) + bool_value
print(result)
```

10. Program:

```
Bill_Amount = int(input("Enter the billing amount: "))
Discount = Bill_Amount * 0.1
if Bill_Amount > 5000:
    Net_Amount = Bill_Amount - Discount
    print("The net billing amount is: ", Net_Amount)
else:
    print("The net billing amount is: ", Bill_Amount)
```

11. Program:

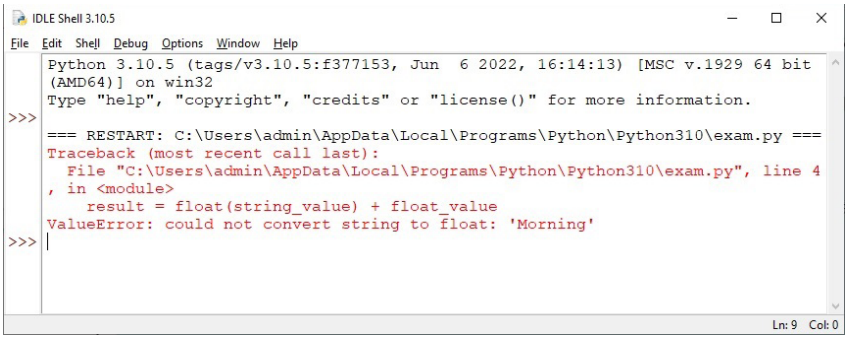
```
Y = int(input("Enter the year: "))
if (Y % 4) ==0:
        print("The year entered is a leap year")
    else:
        print("The year entered is not a leap year")
```

12. Program:

```
bool_value = True
string_value = "Hello"
result = str(bool_value) + string_value
print(result)
```

13. Program:

```
string_value = "Morning"
float_value = 90.4
result = float(string_value) + float_value
print(result)
Error: could not convert string to float: 'Morning'
```



Ai Lab

1. Start

   Input Basic, Allowances, Deductions

   Net Salary = (Basic + Allowances - Deductions)

   Display Net Salary

   Stop

2. Start

   Input marks1, marks 2

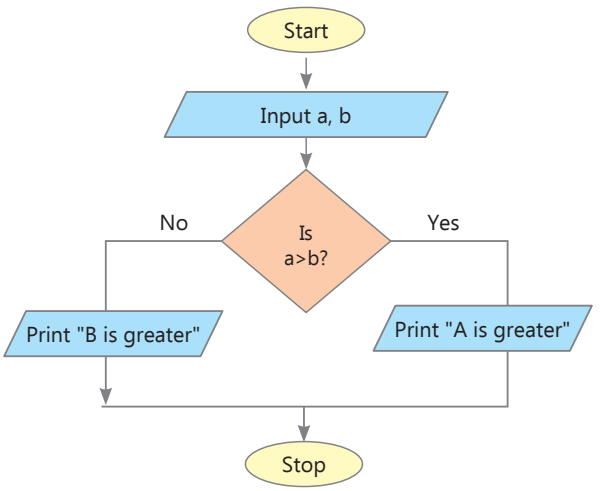
   if marks1 > marks2

   Display marks1 is larger

   else

   Display marks 2 is larger

   Stop



3. a. Program:

```
C = int(input("Enter the temperature in celcius: "))
F = (C  * 1.8) + 32
print(C, "degree celcius  is equal to ", F, "fahrenheit")
```

   b. Program:

```
list1=[]
for i in range (5):
     name=input("enter the name")
     list1.append(name)
```

```
for i in list1:
    print (i, end=" ")
```

c. Program:

```
x = 22
y = 14
temp = x
x = y
y = temp
print('The value of x after swapping: ', x)
print('The value of y after swapping: ', y)
```

d. Program:

```
K = float(input("Enter the distance in kilometres: "))
M = K * 1000
print("The distance in metres is: ", M)
```

e. Program:

```
a = float(input("Enter the side of the square: "))
print("The area of the square is: ", a * a)
```

f. Program:

```
data = [10, 20, 30, 40]
print("List before swap:", data)
i = 0
while i < data.__len__() - 1:
    t = data[i]
    data[i] = data[i + 1]
    data[i + 1] = t
    i = i + 2
print("List after swap:", data)
```

g. Program:

```
L1 = ["Delhi", "Mumbai", "Kolkata", "Chennai", "Bangalore"]
City = input("Enter the city you wish to search: ")
if City in L1:
    print("The city name you entered is in the list")
      else:
    print("The city name you entered is not in the list")
```

h Program:

```
marks = [40, 45, 50, 46, 42]
for i in range(5):
    print((marks[i] / 50) * 100)
```

i. Program:

```
test_list = ['gfg', 1, 2, 'is', 'best']
print("The original list : " + str(test_list))
res_str = [ele for ele in test_list if isinstance(ele, str)]
res_int = [ele for ele in test_list if isinstance(ele, int)]
print("Integer list : " + str(res_int))
print("String list : " + str(res_str))
```

j. Program:

```
marks = [45, 75, 90, 50, 88]
for i in range(5):
    if marks[i] > 50:
        print(marks[i])
```

4. a. 15

b. ['G', 'R', 'A', 'M']

['M', 'R', 'O', 'P']

c. 2

1

d. [1, 2, 3, 1, 2, 3, 1, 2, 3]

e. [10, 20, 25]

[10, 20, 25, 30, 40]