Class 10

Answer Key

Artificial Intelligence Ver. 2.0

Part-B: Subject Specific Skills

1. Introduction to AI

Ai Task (Page 129, 130)

I would choose box 3 – Free coaching voucher if I join coaching classes. I will have access to sample papers as well as reference books.

Ai Task (Page 143, 144)

Scenario 1:

As a developer, I would choose option 2. As the life of a human being is much more precious than the non-living object – car that can be repaired with some expense, however, a human life is irreparable.

Scenario 2:

The Manufacturing Company will be responsible for the algorithm of the automatic car. It is approved, tested, evaluated and implemented by the manufacturer. The person who bought the car is just the consumer of the made product.

Ai Reboot (Page 144)

1. AI applications use a huge amount of data for extracting information from it and to make appropriate decision.
2. It is always advisable not to give these permissions to these apps and websites otherwise you may end up making your data easily available to the whole world unknowingly.

Ai Task (Page 145)

1. Yes, he is doing the right thing. As of now, AI technology is very expensive and not readily available; however, labourers are cheap and easily available.
2. Advantages are:
   a. Reduce the risk of accidents in the workplace
   b. Don't need to take breaks

   Disadvantages are:
   a. Can be very expensive
   b. Unemployment may rise

IMPRINT 1

Ai Task (Page 146)

Every kitchen appliance advertisement has female models in typical feminine roles—in the kitchen.

Ai Task (Page 147)

1. AI enabled games that the kids play are way above the age group and know that they should be.
2. NLP can be used effectively for kids for the purpose of phonetics. In primary classes, students are taught the phonetics of the language.

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

Ai Quiz

A.

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

B.

1. NLP	2. Chatbots	3. using technology
4. expensive	5. Natural language	6. Musical intelligence
7. Data, algorithm	8. adapt	9. natural
10. Spatial		

C.

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

SECTION B (Subjective Type Questions)

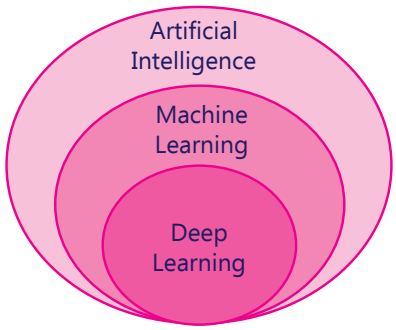
A.

1. The three important points considered for defining the term intelligence are learning, understanding the information and applying that knowledge to your life.
2. Data and Algorithm
3. Automatic washing machine, Air conditioners or remote-control fans, and Remote control toys-cars are the examples which are not AI.
4. Artificial Intelligence (AI) is the software engine that drives the Fourth Industrial Revolution. Its impact can already be seen in homes, businesses and political processes. In its embodied form of robots, it will soon be driving cars, stocking warehouses and caring for the young and elderly. It holds the promise of solving some of the most pressing issues facing society, but also presents challenges such as inscrutable "black box" algorithms, unethical use of data and potential job displacement. As rapid advances in machine learning (ML) increase the scope and scale of AI's deployment across all aspects of daily life, and as the technology itself can learn and change on its own, multi-stakeholder collaboration is required to optimize accountability, transparency, privacy and impartiality to create trust.

IMPRINT 1

5. Face Lock in Smartphones and Self-driving Cars
6. Autocorrect Feature and Chatbot

B. 1. Machine Learning is a subset of AI which uses statistical methods to enable machines to improve with experience. It is one of the most popular techniques to build AI systems across the globe. It is the science of getting machines to interpret, process and analyse data in order to solve problems.



Deep Learning is a subset of machine learning that is inspired by the functionality of our brain cells called neurons which led to the concept of artificial neural networks. It is a process of implementing neural networks on high dimensional data to gain insight and form solutions.

2.

Parameters	Deep Learning	Machine Learning
Data Dependency	When the size of the data is small, a deep learning algorithm does not perform well as a deep learning algorithm needs large amounts of data to understand perfectly.	Machine Learning algorithm can easily work with smaller data set.
Hardware Dependency	Deep Learning algorithms are heavily dependent on high-end machines	Machine Learning algorithms can work on low end machines as well.
Problem Solving Approach	Deep Learning algorithm solves the problem end to end.	When we are solving a problem using a traditional machine learning algorithm it is generally recommended that we first break down the problem into different sub parts and solve them individually and then finally combine them to get the desired result.

Execution Time	Usually, Deep Learning algorithms take a long time to train because there are many parameters making the training time longer than usual.	Machine Learning algorithms take much less time to train.

3. Musical Intelligence is the skill of composing, performing and appreciating musical patterns. The people with this Intelligence have an ability to recognize tone, rhythm and timbre. On the other hand, Logical-Mathematical Intelligence is the ability to quantify things, analyzing problems logically, making hypotheses and solving them. The people with this Intelligence think in terms of cause and effect.
4. Decision making is the process of comparing our different alternatives and coming to a conclusion on what exactly you want to do. Our brain plays a very important role in making all types of decisions to deal with different problems in life. We make decisions every day, starting from saying to doing, consciously or unconsciously. Everything we do is a result of our decisions.

C. Competency-based/Application-based questions:

1. d
2. Vivek was using the NLP domain of AI.

Ai Ready 1

1. An algorithm is a set of instructions for solving a problem. On the other hand, Machine Learning is a subset of AI which uses statistical methods to enable machines to improve with experience. It is one of the most popular techniques to build AI systems across the globe.
2. Structured decision problems are routine in nature. They are easily understood by the organization. On the other hand, unstructured decision problems are novel and infrequent in nature. These problems may be difficult to recognize upon initial occurrence.
3. AI policy is defined as public policies that maximize the benefits of AI, while minimizing its potential costs and risks.
4. Natural Language Processing is the domain of artificial intelligence where a machine uses algorithms to understand, analyse, and interact with humans using natural language. It focuses on processing the text in a literal sense on the other hand, NLU focuses on extracting the context and intent of the text.

2. AI Project Cycle

Ai Task (Page 160, 161)

Planning:

a. Identify the date for Teacher's Day celebration.

b. Decide on the activities and events for the celebration.

c. Allocate responsibilities to students for different tasks.

Organizing:

a. Create a schedule/timeline for the celebration day.

b. Arrange necessary materials and resources for activities.

c. Coordinate with classmates to ensure everyone is on the same page.

Executing:

a. Follow the planned schedule on the day of the celebration.

b. Carry out the activities, such as speeches, performances, or games.

c. Ensure that decorations and any special arrangements are in place.

Implementing:

a. Monitor the progress of the celebration to ensure everything is going smoothly.

b. Address any unforeseen issues or last-minute changes promptly.

c. Encourage active participation and engagement from all students.

Video Session (Page 173)

Accept all relevant answers.

Ai Reboot (Page 174)

1. The Learning Based Approach can be divided into three sections which are Supervised Learning, Unsupervised Learning and Reinforcement Learning.
2. Two important features of Neural Network are:
   - The model of the AI Neural network is based on the human neural network i.e., brain and Nervous system.
   - They are designed in such a way that the information can be automatically extracted without the interaction of the programmer.

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

AI Quiz

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

B. 1. Neural Networks 2. Evaluation 3. Dimensionality Reduction
4. Clustering and Dimensionality Reduction 5. Classification

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

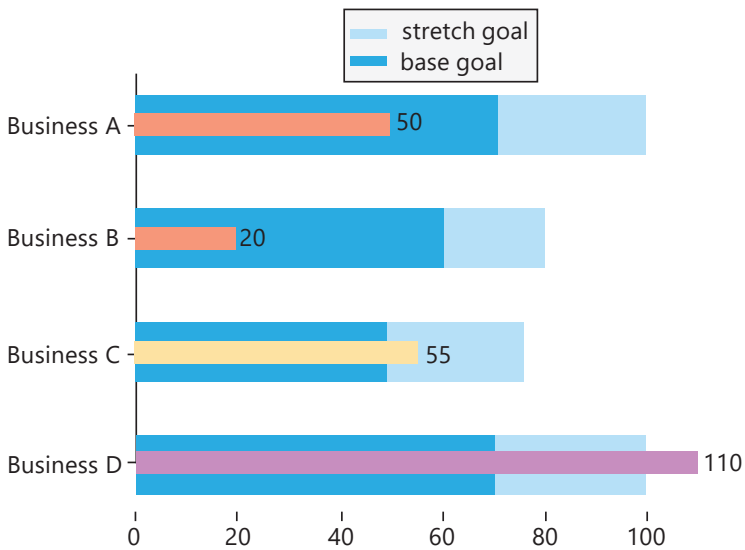
SECTION B (Subjective Type Questions)

A. 1. AI modelling can be classified into 2 approaches which are:

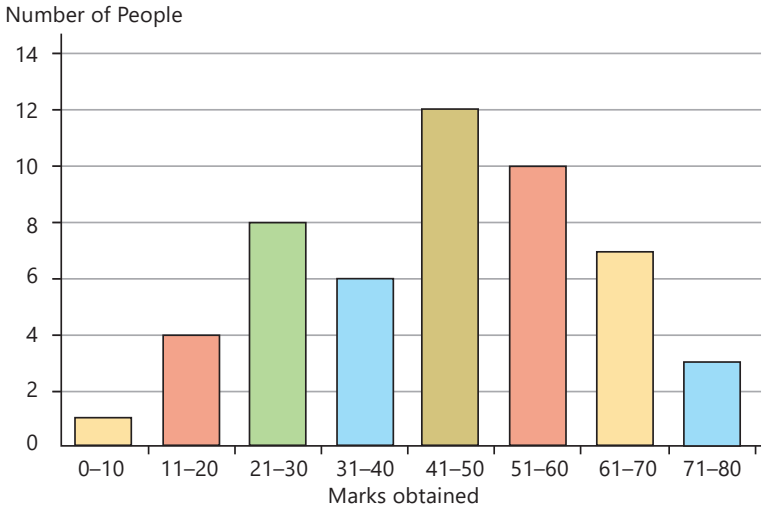
- **Rule Based Approach:** This approach is based on a set of rules and facts defined by the developer and fed to the machine to perform its task accordingly to generate the desired output.
- **Learning Based Approach:** This approach refers to the model where the relationship or patterns in the data are not defined by the developer.

2. Data Visualisation Techniques are:

- **Bullet Graphs:** It is just like a bar graph with extra visual elements for more explanatory comparison.



- **Histogram:** It is bar graph-like representation of data where data is on x axis and the number, count or percentage of occurrences in the data will be on y axis.



3. The data can be collected through:
   - **Surveys:** Customer's feedback and reviews.
   - **Web scraping:** Data extracted from various web pages.
   - **Sensors:** Data collected from various sensors to track the conditions of physical things can be monitored in real time.
   - **Cameras:** Live data from surveillance cameras, web cameras, etc.
   - **Observations:** Reading and analysing trends.
   - **Application Programming Interface (API):** Application programs generate data of their own while working, like data on their servers.
   - **Government Portals:** There are some authentic sources of information in the form of open-sourced websites hosted by the government.
4. The 4Ws Problem Canvas includes the following four questions:
   - **Who?:** The "Who" block helps in analyzing the people getting affected directly or indirectly due to it. Under this, we find out who are the 'Stakeholders' to this problem and what we know about them.
   - **What?:** Under the "What" block, you need to look into what you have on hand. At this stage, you need to determine the nature of the problem.
   - **Where?:** This block will help you look into the situation in which the problem arises, the context of it, and the locations where it is prominent.
   - **Why?:** In the "Why" canvas, think about the benefits which the stakeholders would get from the solution and how it will benefit them as well as the society.

5. Rule based approach is based on a set of rules and facts defined by the developer and fed to the machine to perform its task accordingly to generate the desired output.

   On the other hand, learning based approach refers to the model where the relationship or patterns in the data are not defined by the developer.

B. 1. Advantages of Neural Networks are:

   - It can extract data features automatically without the input from the developer.
   - It is fast and efficient way to solve problems with large datasets, such as images.
   - It is essentially a system of machine learning algorithms to perform certain tasks.

2. Data Exploration is the third stage in the AI project cycle. It refers to exploring the large data to uncover the patterns or trends needed for the AI project.

   It is considered to be the first step in data analysis where unstructured data is explored, researched, filtered and visualised to decide the strategy for the type of model used in the later stage.

   For example, if you have to buy a laptop, you need to explore your requirements of the configuration that you want, of the RAM, hard disk, processor, operating system, graphic card, touch screen or not, etc. But from this unstructured data you have to choose the one that suits the best to your needs.

3. Visualisation of the data plays a very important role in data analysis. This visualisation process has to be carried in some user-friendly format so that you can:

   - Quickly get a sense of the trends, relationships and patterns contained within the data.
   - Define strategy for which model to use at a later stage.
   - Communicate the same to others effectively.

4. Reinforcement learning is a type of learning based approach where a machine learning algorithm enables an agent (machine with an intelligent code) to learn in an environment to find the best possible behavior or path it should take by performing certain actions that maximize the total cumulative reward of the agent. In this learning approach the agent learns automatically by using hit and trial methods or through its own experience using rewards and penalties. Each action performed by an agent gives reward for correct move and it signals positive feedback. For wrong move it generates negative feedback and gets punishment and a penalty.

5. **Dimensionality Reduction:** Humans can visualise any figure up to 3-Dimensions only but according to a lot of theories and algorithms, there are various entities which exist beyond 3-Dimensions. For example, in Natural Language Processing, the words are considered to be N-Dimensional entities. This means that we cannot visualise them as they exist beyond our visualisation ability. Hence, to make sense out of it, we need to reduce their dimensions which we do by using dimensionality reduction algorithm. As we reduce the dimension of an entity, the information which it contains starts getting distorted. So, we use Dimensionality Reduction here which reduces the dimensions and makes it sensible data..

D. Competency-based/Application-based questions:

1.

Our	Over 2 billion people live in water-stressed countries,	Who
Has a problem that	Climate change, increasing water scarcity, population growth, demographic changes and urbanization already pose challenges for water supply systems.	What
When/ While	In water-stressed countries	Where
An ideal solution would be	Steps to be taken to save water should be adopted. So that we can avoid diseases and wars due to water scarcity.	Why

2. B

Ai Deep Thinking (Page 184)

Do yourself.

Ai Lab (Page 184, 185, 186)

Do yourself.

Class Activity page 187

Do Yourself

Ai Ready 2

1. The complexity comes from the number of observation categories — usually a variable and its data—along with the data type (numeric or categorical). Complexity of data leads to difficulty in choice of data visualization technique, that in turn results in poor communication of facts and trends for the next phase of AI project life cycle that will lead to unsatisfactory modelling and deployment of project.
2. Data visualization is an important part of an AI system. It helps both user and the developer of AI system. The user can easily understand the complex data with the help of data visualization. User is always concerned about the adoption of AI systems. So, visualization helps to explain and understand these systems therefore it is not advisable to design AI systems without Data Visualization.
3. This is the first and the crucial stage of AI Project development which focuses on identifying and understanding problems using 4Ws— Who, What, Where and Why. It is the analytics approach that involves taking steps to solve the problems and setting up goals that we want our project to achieve.
4. **IT Project Cycle:**
   - Initiation-The project kick off phase
   - Planning- Detail all the work, how you plan on doing it

- Execution- When you put everything you planned into deliverables
- Monitoring-Monitoring project's overall progress to see if you are on track
- Closure- The closure phase wraps things up with final documentation.

AI project cycle: It has following phases:
Problem scoping, Data Acquisition, Data exploration, Modelling and Evaluation
While both AI projects and IT projects follow a similar project lifecycle, AI projects have specific phases related to data collection, model development, and training, which are unique to AI technologies. Additionally, AI projects often require specialized skills in machine learning, data science, and AI algorithms, whereas IT projects may focus more on software development, system integration, and infrastructure management.

3. Advance Python

Ai Task (Page 210)

8.0 45.2 44 60 65

Ai Reboot (Page 203)

1. Conditional statements are used for selecting the block of statements to be executed based on the condition.
2. There are two types of looping statements in Python which are while and for. The "while" loop is used to repeat a set of instructions as long as the condition is True. The "for" loop is used to repeat a set of instructions for a fixed number of times.

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

Ai Quiz

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

B. 1. Relational 2. sep 3. for and while
4. keywords 5. else 6. input( )
7. Data type 8. Augmented assignment
9. / and // 10. Monty Python's Flying Circus

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

SECTION B (Subjective Type Questions)

A. 1. a. We cannot assign a value to a literal. The correct code is name = "abc"
b. Closing double quotes are missing. Correct code is print("hello class")

c. Double quotes are missing. n=input(”enter a number”)

d. Incorrect declaration. Correct declaration is n1, n2 = 10, 20

e. Incorrect expression. Correct expression is a = 20/10

f. Incorrect expression. Correct expression is c = a + b

g. Double quotes and closing parenthesis are missing. Correct code is

```
num=int(input(“enter your name”))
```

2. a. False b. 10 c. 8.0 d. 510

e. 19.2 f. –4

3. a. Invalid. Keywords cannot be used as an identifier

b. Invalid. Space is not allowed in an identifier name

c. Invalid. Special symbols are not allowed except (_)

d. Valid

e. Valid

f. Invalid. Space is not allowed in an identifier name

g. Valid

B. 1. a. The else statement is an optional statement used with the “if” statement. Only one else statement is used with one “if” statement. On the other hand, multiple “elif” statements can be used with the “if” statement. Usage of “else” is mandatory after the use of “elif” in the “if” block.

b. The while loop is used to repeat a set of instructions as long as the condition is True. On the other hand, the for loop is used to repeat a set of instructions for a fixed number of times.

c. The print( ) statement is used to display output on the terminal. On the other hand, input( ) statement is used to take input from the user at the terminal.

d. The sep parameter is used to separate objects if there are more than one objects. Default is space ‘ ‘. It is optional. On the other hand, the end parameter is used to specify what to print at the end. Default is newline ‘\n’. It is optional.

e. Division operator / divides two values. On the other hand, Floor division operator // divides the first number with the second and returns the whole number adjusted left to the number line.

f. Comparison or relational operators compare the values given on both sides of the operators and based on the evaluation returns the Boolean value True or False.

Logical operators are used to combine one or more conditional statements and returns either True or False based on the evaluation of the conditions.

2. Keywords have special meaning which are reserved by Python for special purposes and are not allowed to be used as identifiers. They are case sensitive. The def keyword is used to define a function in Python. The sep keyword is used to separate two objects. The if keyword

is used to apply conditional statement. The int keyword is used to explicitly define integer variables.

3. Indentation refers to the spaces at the beginning of a code line. A block is identified by using an indentation (minimum 1 space). Ensure that all statements in one block are indented at the same level. Without indentation, program will not run as expected.
4. Python allows you assign multiple variables in one line in the following way:

   a, b, c = 10, 20, 30

   In this case, the values 10, 20 and 30 is assigned to the variables a, b and c respectively. Python also allows you to assign a single value to multiple variables in the following way:

   a = b = c = 10

   In this case, the value 10 is assigned to the variables a, b and c.

Ai Lab

a.
```
PI = 3.14
r = float(input('Enter the radius of a circle: '))
circumference = 2 * PI * r
area = PI * r * r
print("Circumference of the Circle is: ", circumference)
print("Area of the circle is: ", area)
```

b.
```
num1 = 5
num2 = 10
num3 = 20
avg = (num1 + num2 + num3)/3
print('The average of numbers is: ', avg)
```

c.
```
n1 = float(input("Enter first number: "))
n2 = float(input("Enter second number: "))
n3 = float(input("Enter third number: "))
if (n1 > n2) and (n1 > n3):
  l = num1
elif (n2 > n1) and (n2 > n3):
  l = n2
else:
  l = n3
print("The largest number is",l)
```

d.
```
start, end = 21, 50
for num in range(start, end + 1):
  if num % 2 == 0:
    print(num, end = " ")
```

e.
```
s = "HELLO"
str = ""
for i in s:
  str = i + str
print(str)
```

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

g.
```
num1 = int(input("Enter first number: "))
num2 = int(input("Enter second number: "))
num3 = int(input("Enter third number: "))
num4 = int(input("Enter fourth number: "))
num5 = int(input("Enter fifth number: "))
result = num1 + num2 + num3 + num4 + num5
print(result)
```

h.
```
num = int(input("Enter a number: "))
while(num>0):
  print("Name")# you may use your name
  num=num - 1
```

Ai Ready 3

1. There are many programming languages .

   Python gained its popularity due to the following reasons:

   a. It is Easy to Read, Write, Learn and Maintain:

   b. Large Standard Library

   c. Interactive Mode

   d. Portability and Compatibility

e. Extendable

f. Databases and Scalable

2. The Role of Python in Artificial Intelligence

a. Simplicity of Python

b. The efficient ecosystem of the library

c. Independence of platform

d. Easy integration with data processing and visualization

e. Flexibility while coding

f. Less coding but more efficiency

g. The speed of development

3. Python is arguably the most popular language for AI and machine learning development due to its simplicity, readability, and extensive ecosystem of libraries and frameworks.
4. AI is developed using python coding or using other languages like R, JAVA,C++ etc.

4. Data Science

Ai Task (Page 235)

Accept all relevant answers

Ai Task (Page 241)

```
<class 'numpy.ndarray'>
```

Ai Task (Page 252)

xlabel() sets the title of the X-Axis as Date in 14 pt font size.

ylabel() sets the title of the Y-Axis Subject in 14 pt font size.

title() sets the title of the chart as **Test Marks Subject wise**.

Ai Task (Page 253)

Accept all relevant answers.

Ai Reboot (Page 256)

1. Personality Prediction Project identifies the personality of an individual using machine learning algorithms and big 5 models.
2. K-Nearest Neighbour Model is a supervised machine learning algorithm based on supervised learning technique.

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

AI Quiz

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

B. 1. Data Science 2. Virtual Reality 3. Matplotlib
4. Package 5. Arrays 6. John D. Hunter
7. bar( )
8. For odd number of datasets:

$$\left(\frac{(N+1)}{2}\right)^{th} \text{ term}$$

For even number of datasets:

$$\left[\left(\frac{N}{2}\right)^{th} \text{ term} + \left(\frac{N}{2+1}\right)^{th} \text{ term}\right] / 2$$

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

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

SECTION B (Subjective Type Questions)

A. 1. Pandas is an open-source Python library used for data manipulation and data analysis.

2. Problem Scoping, Data Acquisition, Data Exploration, Data Modelling and Data Evaluation

3. Erroneous Data means the values in a dataset is not received as per the expectations in that position. There are two ways in which the data can be erroneous:

   - **Incorrect Values:** The values in the dataset at random places are not correct. Either the data is mismatched or it is not relevant to that position.
   - **Invalid or Null Values:** It means value either corrupted or has no meaning. These values when occurring in a dataset need to be removed as they hold no value for data processing.

B. 1. Mean is the average of numeric data in a given dataset. So, we add all of the numbers together of the dataset and divide by the number of elements in the given set.

It is calculated as:

$$\text{Mean} = \frac{\text{sum of all values}}{\text{total no. of values}}$$

When the data is arranged in an ascending order then median is the middle number in a given dataset. If there are two middle numbers, taking the mean of these two numbers will give the median.

For even number of datasets:

$$\left[\left(\frac{N}{2}\right)^{th}\text{ term} + \left(\frac{N}{2+1}\right)^{th}\text{ term}\right]/2$$

2. The following are some of the popular tabular formats of storing data:
   - **Spreadsheets:** Data stored in the form of rows and columns under a filename is a spreadsheet application. It's a powerful tool for analysis, visual representation, calculations and accounting purposes. Some popular spreadsheet applications are MS Excel, Open Office Spreadsheet, etc.
   - **Comma Separated Values (CSV):** These are files with extension of .csv that contain records with each value separated with commas. Every line is a single record. These files are created using Excel, Google Sheets, and also simple word processing programs like Notepad.
   - **Structured Query Language (SQL):** A query language that is used to store, manage and retrieve data from DBMS. It's a domain specific language primarily used to handle structured data in database management systems.
3. A collection of relevant modules saved under the same directory and a name is called a Package. Some of the open-source packages available needed for Artificial Intelligence are:
   - **NumPy:** Numerical Array Data Handling Package. It is used for data analysis and calculation related to large numerical data sets.
   - **OpenCV:** Image Processing Package. It is used for manipulating and processing of images like cropping, resizing, editing etc.
   - **Matplotlib:** Data Visualisation Package. It is used for the graphical representation to produce high quality data visualization of the numerical data.

C. Competency-based/Application-based questions:

1. d. Numpy

Ai In Life (Page 262)

Do yourself.

Ai Deep Thinking (Page 262)

Do yourself.

Ai Lab (Page 262)

Do yourself.

Ai Ready 3

1. Following are some of the advantages of NumPy array over Python list:
   - NumPy arrays allow faster access in reading and writing items effectively and efficiently.
   - In arrays the mathematical operators can be directly used whereas in list the mathematical operators cannot be used directly.
   - Arrays are mainly used for mathematical operations where lists are mainly used for data management.
   - Arrays can be accessed only through package NumPy and occupies less memory space whereas list occupies more memory space and can be accessed directly in Python without any package support.
2. Any type of data required can be collected from various sources. Nowadays many options are available in order to collect data from online as well as offline sources.

   The following are some of the sources available:

   Online mode: Open-source Govt. portals, WHO websites.

   Offline mode: Surveys, questionnaires, experiments, personal interviews.
3. Data Science plays a very important role in Artificial Intelligence. This structured data when given to the AI model will make the system intelligent. The companies use data to improve their products. Data Science is used to give the right direction to the companies to achieve their goals.
4. **Erroneous Data:** It means the values in a dataset is not received as per the expectations in that position.

   Missing Data: It means data not present at the desired location of a dataset. Missing data is not erroneous data.

   Outliers Data: It means the data that differs drastically from the rest of the data. This kind of unusual data needs to be removed or replaced from the dataset for accurate results.

5. Computer Vision

Ai Reboot (Page 270)

1. Humans see an object when the light bounces off an object and enters the eyes through the cornea. Then through the nerves it enters the retina which is involved in color vision. Once an object is seen by the eyes it needs to be understood by the brain. The next step is to understand what the image is, and that is done by our brain. Our brain then identifies and understands other information like color, shape, movement and other details about the image.

Ai Task (Page 273)

1. White color
2. Black color
3. It changes color as per color pallet.
4. This results in a change in brightness or intensity while maintaining the same hue
5. Turquoise – (48, 213, 200), You may write your favourite color

Ai Task (Page 273)

Accept all relevant answers.

Ai Task (Page 274)

1. Yes
2. B E
3. Corners

Ai Task (Page 281)

1. Blue
2. Green

Ai Task (Page 281)

Do Yourself

Ai Task (Page 283)

Do Yourself

Video Session (Page 286)

Accept all relevant answers.

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

Ai Quiz

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

B. 1. Computer Vision 2. inferences 3. Classification
4. Instance Segmentation 5. Pixel 6. Image
7. Computer Vision 8. cvtColor( ) 9. Region of Interest
10. resize() 11. Convolutional Neural Network
12. artificial neurons 13. Neural Networks 14. nodes
15. activation

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

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

SECTION B (Subjective Type Questions)

A. 1. The three main differences between human vision and computer vision are:

Human Vision	Computer Vision
It is multitasking.	It is task oriented.
It is extremely sensitive to other human faces.	It is trained to see human faces.
It can perceive better and faster in complex situations.	It may not perceive in complex situations.

2. Pixel stands for "Picture Element". It is the smallest unit of information in a digital image. These pixels are arranged in a 2-dimensional grid to form a complete image, video, text, or any visible thing on a digital platform. A pixel can have only one color at a time.
3. In computer vision an image feature is simply a piece of information about the content of an image. It can be an edge, corners, start point or end point that can be taken.
4. OpenCV stands for Open-Source Computer Vision Library, originally developed by Intel and officially launched in 1999. It is an open-source software library for computer vision and machine learning that helps a computer understand the content of digital images like photographs and videos.
5. The image copy can be saved on the drive by using imwrite() function. The code is:

```
import cv2 # import OpenCV
from matplotlib import pyplot as plt # import matplotlib
import numpy as np # import numpy
img = cv2.imread('D:\Buddy.jpg')   #Load the image file into memory
roi = img[20:230,120:372] #img[range of y, range of x]
resized = cv2.resize(img, (200,400))
cv2.imwrite('D:\Only face.jpg',roi)
cv2.imwrite('D:\Resized.jpg',resized)
```

B. 1. Multiple Objects means giving multiple images as input to the Computer Vision application. It can be further divided into two categories:

- **Object Detection:** It is the process of identifying or detecting the instances of real-world objects like cars, bicycles, buses, animals, humans, or anything on which the detection model has been trained. This kind of system uses Object detection algorithms to extract the features of the object and after that machine learning algorithms will recognize the instances of an object category by matching it with the sample images already fed into the system. It is commonly used in applications such as image retrieval and automated vehicle parking systems.

- **Instance Segmentation:** It is the process of division of an image into smaller objects so that the machine can identify an object from the background or by using information about other objects present along with it in the input image. After it has identified it, then each pixel is given a label on the basis of that. A segmentation algorithm takes an image as input and outputs a collection of regions (or segments).

2. The imshow( ) function is used to display an image in a window. It can change the image to grayscale and it can also be used for converting image from BGR to RGB. For example:

```
plt.imshow(img, cmap = 'gray')
```

3. Sometimes we need to remove the unwanted parts of the image to make it appear in a frame and help us focus on certain areas of the image.

   This can be done by cropping an image. The code is:

```
import cv2 # import OpenCV
from matplotlib import pyplot as plt # import matplotlib
import numpy as np # import numpy
img = cv2.imread('D:\Buddy.jpg')   #Load the image file into memory
roi = img[20:230,120:372] #img[range of y, range of x]
plt.imshow(cv2.cvtColor(roi, cv2.COLOR_BGR2RGB))
plt.title('face')
plt.axis('off')
plt.show()
```

4. You must have filters downloaded in your smartphones that help you hide your one big pimple that suddenly appeared on your chin and spoiled your look or make your cheeks blusher and your lip colour of the same shade to enhance your looks just before you upload your picture on social websites like Facebook, Instagram, Twitter, Snapchat and many others.

   These filters that help you improve the image quality or edit the pixel values in Photoshop are actually changing the pixel values evenly throughout the image with the help of convolution or the convolution operator.

   Technically, convolution is defined as a simple Mathematical operation that multiplies two numeric arrays of the same dimensions but different sizes to produce a third numeric array of the same dimensions.

5. Fully Connected Layer is the last and the final layer of the Convolutional Neural Network. After the features of the input image are extracted by the convolution layers and downsampled by the pooling layers, their output is a 3-dimensional matrix which is flattened into a vector of values. These values of the single vector represent a specific feature of a specific label and are redirected to fully connected layers to predict the final outputs of the network. This helps in classifying an image into a specific label based on the probability of the input being in a specific class.

C. Competency-based/Application-based questions:

1. b.

Ai In Life (Page 293)

Accept all relevant answers

Ai Deep Thinking (Page 293)

Accept all relevant answers

Ai Lab (Page 293)

Do yourself.

Class Activity page 296

Do Yourself

Ai Ready 4

1. 4K Resolution: 4K resolution, also known as Ultra High Definition (UHD), typically refers to a resolution of 3840 pixels × 2160 lines, which gives it approximately 8.3 megapixels. It's called 4K because it's roughly four times the resolution of Full HD (1920 x 1080 pixels).

   8K Resolution: 8K resolution, also known as Super Hi-Vision, usually refers to a resolution of 7680 pixels × 4320 lines, which translates to about 33.2 megapixels. It's called 8K because it's approximately eight times the resolution of Full HD.

2. Almost in all industries it's being used to increase productivity. Things like Hi-Speed uploading for varied carton sizes, efficient movement of finished products through autonomous forklift and many more, such vision-based robotics or machines are used for efficient and faster work.

3. Convolution is the first layer of a CNN and is also known as Feature Extractor Layer. The main purpose of this layer is to extract the high-level features from the input image to perform operations such as edge detection, blur and sharpen by applying filters.

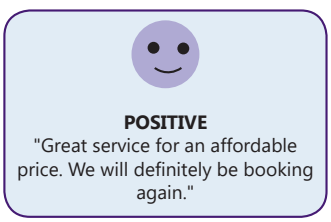
   Depending on the type of AI model, a Convolution Layer may be made up of two or more layers. In that case the first Convolution Layer is responsible for capturing the Low-Level features such as edges, colour, gradient orientation, etc. With added layers, the architecture adapts to the High-Level features and a whole network of understanding of images in the dataset

4. There are many applications of Computer Vision in AI. Following are the two.
   a. Statistics and player tracking: Athlete tracking and analysis is one of the most popular Computer Vision Applications in Fitness & Sports. Thanks to cameras and sensors, sports teams can monitor individual players' movements and performance in real time. This information is used to evaluate player performance. It is used to identify strengths and weaknesses and create a development plan.
   b. Judge support: Referee Assist is a computerised viewing system used in sports. Referees can make quick and accurate decisions using a computer vision system using cameras and algorithms. For example, in soccer, computer vision can be used to determine if a player is offside or if the ball has crossed the goal line. In basketball, computer vision can be used to distinguish between two-pointers and three-pointers.

6. Natural Language Processing

Ai Task (Page 300)

1.



2. Best - Rating 5
   Very Good - Rating 4
   Good - Rating 3
   Average - Rating 2
   Bad - Rating 1

Ai Reboot (Page 304)

1. Surveys and interviews of people in various stages of life using online and offline mode.

   Observations from the therapist's clinic.

   Web scraping: Data collected from web of people who are looking for assistance in stress management and vent out ways.

2. **Data Evaluation:** The model is tested with the testing data. It is evaluated for the accuracy of the answers which the machine gives to the user's response. The AI model is then evaluated and compared to see its efficiency.

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

AI Quiz

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

B. 1. Smart-bot 2. sentiment analysis 3. Human Language
4. token 5. Stemming 6. Bag of Words
7. Tokenization 8. TFIDF 9. Text Normalisation
10. Lemmatization

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

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

SECTION B (Subjective Type Questions)

A. 1. The Steps involved in Bag of Words algorithm are:

- **Text Normalisation:** The collection of data is processed to get normalised corpus.
- **Create Dictionary:** This step will create a list of all unique words available in normalised corpus.
- **Create Document Vectors:** For each document in the corpus, create a list of unique words with its number of occurrences.
- **Create Document Vectors for all the Documents:** Repeat Step 3 for all documents in the corpus to create a "Document Vector Table".

2. Chatbot can be defined as an application that automates your tasks like saying good morning when you wake up, telling you news on a daily basis, helping you in choosing a less traffic route for your school, ordering a coffee for you on your way back home. Mitsuku bot, Haptik, Ochatbot etc.
3. Two applications of chatbot are:
   - It helping you in choosing a less traffic route for your school.
   - It ordering a coffee for you on your way back home.
4. Automatic Text Summarization is the process of creating the most meaningful and relevant summary of voluminous texts from multiple resources.

B. 1. a. Document Frequency is the number of documents in which the word occurs irrespective of how many times it has occurred in those documents. On the other hand, Inverse Document Frequency is obtained when document frequency is in the denominator and the total number of documents is the numerator.

b. Bag of Words is a simple and important technique used in Natural Language Processing for extracting features from the textual data.

On the other hand, Term Frequency and Inverse Document Frequency (TFIDF) method is considered better than the Bag of Words algorithm because BoW gives the numeric vector of each word in the document but TFIDF through its numeric value gives us the importance of each word in the document.

c. **Extractive summarization:** In this the selected text, phrases, sentences or sections are picked up from the scattered resources and joined appropriately to form a concise summary.

Abstractive Summarization: In this, the summary is created by interpreting the text from multiple resources using advanced NLP techniques. This new summary may or may not have text, phrases or sentences from the original documents.

d. Humans Language is the language used by humans to interact with the people around them. Whereas, Computer Language is a language used by the programmers to develop a computer program which helps humans to interact with an electronic device-computer.

2. Data Acquisition means collecting raw data for the purpose of reference or analysis for the project. This is the second stage of the AI project cycle. It is the process of collecting data required for training the AI project. Data is raw information that is used to generate meaningful outcomes.

3. Some of the important applications of TFIDF are:

- **Document Classification:** It helps in the classification of the documents scattered in the internet based on their types, genre, etc.
- **Topic Modelling:** It helps in predicting the topic of the corpus.

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

1.

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

2. **Step 1:** Text Normalisation

Document 1: Jack and Jill went uphill

Document 2: Jack fell down

Document 3: Jill broke down

Step 2: Create Dictionary

Jack	and	Jill	went	uphill
fell	down	broke	down	

Step 3: Create document vector

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

Jack	and	Jill	went	uphill	fell	down	broke
1	1	1	1	1	0	0	0

Since in the first document, we have words:

Step 4: Repeat for all documents

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

Jack	and	Jill	went	uphill	fell	down	broke
1	1	1	1	1	0	0	0
1	0	0	0	0	1	1	0
0	0	1	0	0	1	1	1

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

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

Term Frequency

Jack	and	Jill	went	uphill	fell	down	broke
1	1	1	1	1	0	0	0
1	0	0	0	0	1	1	0
0	0	1	0	0	1	1	1

Document Frequency

Jack	and	Jill	went	uphill	fell	down	broke
2	1	2	1	1	1	2	1

Inverse document frequency

Jack	and	Jill	went	uphill	fell	down	broke
3/2	3/1	3/2	3/1	3/1	3/1	3/2	3/1

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

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

Jack	and	Jill	went	uphill	fell	down	broke
1*log(3/2)	1*log(3/1)	1*log(3/2)	1*log(3/1)	1*log(3/1)	0*log(3/1)	0*log(3/2)	0*log(3/1)
1*log(3/2)	0*log(3/1)	0*log(3/2)	0*log(3/1)	0*log(3/1)	1*log(3/1)	1*log(3/2)	0*log(3/1)
0*log(3/2)	0*log(3/1)	1*log(3/2)	0*log(3/1)	0*log(3/1)	0*log(3/1)	0*log(3/2)	1*log(3/1)

Jack	and	Jill	went	uphill	fell	down	broke
0.176	0.477	0.176	0.477	0.477	0	0	0
0.176	0	0	0	0	0.477	0.176	0
0	0	0.176	0	0	0	0	0.477

Ai In Life (Page 328)

Do yourself.

Ai Deep Thinking (Page 328)

Do yourself.

Ai Lab (Page 328)

Do yourself.

Ai Ready 5

1. Some of the advantages of Automatic Text Summarization are:
   a. It saves time by condensing a large amount of text into a shorter, more manageable version. Computers are noticeably faster than humans in summarizing.
   b. It is less biased than human summarizers.
2. Sentiment analysis is very significant as it helps business organizations gain insights on consumers and do a competitive comparison and make necessary adjustments in the business strategy development.
3. Automatic Text Summarization, Automatic Text Summarization, Text Classification, Virtual Assistant and Chatbots are some of the real-life applications of NLP.
4. Tokenizing a sentence will split big sentences into smaller sentences. Whereas, Tokenizing a word will split a sentence into words.

7. Evaluation

Ai Reboot (Page 331)

1. Underfitting, Perfect Fit, Overfitting
2. In Underfitting, the model is too simple and performs poorly on both training and test data. It has high bias and low variance. The model fails to capture the underlying patterns in the data.

Ai Task (Page 335)

Accept all relevant answers.

Ai Task (Page 336)

Accept all relevant answers.

Video Session (Page 319)

Accept all relevant answers.

Exercise

Unsolved Questions

SECTION A (Objective Type Questions)

Ai Quiz

A. 1. d

2. **(This correct is incorrect in your book. Please correct this question in your book)**

   Question: If precision is low and recall is high, what will be the F1 score?

   Ans. b

3. c 4. d 5. c
6. c 7. d. 8. b

B. 1. F1 score 2. False Negative 3. Confusion matrix
4. Positive and Negative 5. Type 1 error 6. good
7. reality 8. Precision

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

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

SECTION B (Subjective Type Questions)

A. 1. Confusion matrix helps in measuring the performance of an AI model using the test data.

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

Its formula is:

$$\text{Recall} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Negative}}$$

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

3. Positive, Negative, True Positive, True Negative, False Positive (Type 1 error), False Negative (Type 2 error) are the Terminologies of Confusion Matrix.
4. Lack of Training Data and Unauthenticated Data / Wrong Data are the two reasons for the inefficiency of the AI Model.

B. 1. $\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$

$$= \frac{100 + 32}{100 + 32 + 85 + 80} \times 100$$

$$= \frac{132}{297} \times 100$$

$$= 0.44 \times 100 = 44.44\%$$

$$\text{Precision} = \frac{TP}{TP + FP} = \frac{100}{100 + 32} \times 100$$

$$= \frac{100}{132} \times 100$$

$$= 0.75 \times 100$$

$$= 75.75\%$$

$$\text{Recall} = \frac{TP}{TP + FN} = \frac{100}{100 + 80} \times 100$$

$$= \frac{100}{180} \times 100 \quad = 0.55 \times 100$$

$$= 55.55\%$$

$$\text{F1 Score} = 2 \times \frac{P \times R}{P + R}$$

$$= 2 \times \frac{0.75 \times 0.55}{0.75 + 0.55}$$

$$= 0.6347$$

2. a. a high false negative cost occurs when the system was supposed to respond positively for a question but the system responded in a negative form. it is costly because if the mail

was an important one the AI software would ignore it.

b. A High False positive is also costly because the system brings in a waste message as an important one to the the employees wasting their time thus reducing company's performance.

3. A good F1 score means that you have low false positives and low false negatives, so you're correctly identifying real threats, and you are not disturbed by false alarms.

   F1 score is considered to be a very important and a better evaluation metric in any of the cases of AI model prediction. It is mostly used in real-life classification problems and when imbalanced class distribution exists.

   A model is said to have a good performance if the F1 Score for that model is high.

   An ideal situation occurs when both Precision and Recall have value as 1 i.e., 100%, then F1 score would also be an ideal 1 (100%). It is also known as the perfect value for F1 Score. A model is considered to be a total failure when the F1 score is 0.

4. **True Positive:** The predicted value matches the actual value i.e.; the actual value was positive and the model predicted a positive value.

   False Positive (Type 1 error): The predicted value was falsely predicted i.e.; the actual value was negative but the model predicted a positive value.

C. Activities: To be done autonomously by students, but you may refer the following example:

Let us assume the AI model deployed by the school works as follows.

Total number of students, checked randomly on a day by the AI model for their presence in the school, is 100.

1. True positive(TP): Model predicted that a student will come and she showed up too.

   i.e. Prediction-> True, Reality-> True

   No. of students that showed TP case : 28

2. False positive(FP): Model predicted that a student will come but she did not show up.

   i.e. Prediction-> True, Reality-> False

   No. of students that showed FP case : 15

3. False Negative(FN): Model predicted that a student will NOT come and she showed up.

   i.e. Prediction-> False, Reality-> True

   No. of students that showed FN case : 23

4. a. True Negative(TN): Model predicted that a student will not come and she did not show up.

   i.e. Prediction-> False, Reality-> False

   No. of students that showed TN case : 34

Prediction

	0	1
9	34	15
1	23	27

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

$$= \frac{28 + 34}{28 + 34 + 15 + 23} \times 100$$

$$= 62\%$$

$$\text{Precision} = \frac{TP}{TP + FP} = \frac{28}{28 + 15} \times 100$$

$$= 65.11\%$$

b. I would suggest my friend to start maintaining a database, if he has not maintained it till now. This data can be used for deploying into an AI system that can predict.

2. I would suggest my friend to start maintaining a database if he has not maintained it till now. This data can be used for deploying into an AI system that can predict the requirement of perishable sweets on daily basis. He can collect data under various heads like "raw_material_purchased", "products_sold", and "material_wasted" .My friend can also record the "money_wasted" heading in his database. Such information when fed into the system, will train a better AI prediction model, thus will be able to predict about the sales in the upcoming days. Consequently avoiding losses and making company earn handsome profits every month.

D. Competency-based/Application-based questions:

1. Deciding between precision and recall
   - If you are more concerned about the transform falsely reporting that two records match when they actually don't match, then you should emphasize precision.
   - If you are more concerned about the transform failing to detect records that really do match, then you should emphasize recall.

2.

Confusion Matrix	Reality 0	Reality 1
Predicted Positive	16 (TP)	19 (FP)
Predicted Negative	12 (FN)	9 (TN)

$$\text{Accuracy} = \frac{\text{Correct prediction} \times 100}{\text{Total cases}}$$

$$= \frac{(TP + TN)}{(TP + TN + FP + FN)} \times 100\%$$

$$= \frac{16 + 9}{16 + 9 + 19 + 12} \times 100\%$$

$$= \frac{25}{56} \times 100\% = \mathbf{44.64\%}$$

$$\text{Precision} = \frac{TP}{TP + FP} \times 100\%$$

$$= \frac{16}{16 + 19} \times 100\%$$

$$= \frac{16}{35} \times 100\% = \mathbf{45.71\%}$$

$$\text{Recall} = \frac{TP}{TP + FN} \times 100\%$$

$$= \frac{16}{16 + 12} \times 100\%$$

$$= \frac{16}{28} \times 100\% = \mathbf{57.14\%}$$

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

$$= \frac{2 \times 0.4571 \times 0.5714}{0.4571 + 0.5714}$$

$$= \frac{2 \times 0.5223}{1.0285}$$

$$= 0.5078 = \mathbf{50.78\%}$$