

COMPUTER SCIENCE — 10

UNIT 06

INTRODUCTION TO ARTIFICIAL INTELLIGENCE (AI), AND MACHINE LEARNING (ML)

Topics Covered in this Unit
1. AI, ML & Overview
2. Machine Learning
3. Applications of AI/ML
4. Supervised & Unsupervised Algorithms
5. Evaluating Model Performance
6. Confusion Matrix

Introduction

This unit explains how modern technology goes beyond machines to include intelligent systems that can learn, think, and support decision-making. It introduces Artificial Intelligence (AI) and Machine Learning (ML), the technologies behind tools like voice assistants, ChatGPT, YouTube recommendations, and weather forecasting.

AI, ML & Overview

Q.1 Define AI and ML. Explain its definition and give real-life examples. Also differentiate between AI and ML. 10506001

Ans. ★ *Key Points: Introduction to AI | Introduction to ML | Real-Life Examples*

1. Artificial Intelligence (AI)

AI means teaching machines to do tasks that usually require human intelligence such as understanding voice, recognizing images, or making decisions.

a. Definition: Artificial Intelligence is the ability of a machine or computer program to perform tasks that normally require human thinking and ability.

b. Real Life Examples:

- Urdu speech-to-text apps used in educational institutes including schools.
- Chatbots used by banks for customer support.
- Traffic control systems in big cities such as one introduced by Safe City Authority in Lahore.

2. Machine Learning (ML)

Machine Learning is a part of AI, it means training a machine to learn from data and make decisions on its own without being programmed every time.

a. Definition: ML is a method where computers learn from past data to predict or decide something.

b. Real Life Examples:

- Netflix or YouTube recommend videos based on watching history of users.
- A weather app uses past temperatures to predict weather for next day.

3. Differences between AI and ML

The following table shows the differences between AI and ML.

Feature	AI	ML
Definition	Making machines smart enough to mimic human behavior	Teaching machines to learn from data and improve
Main Goal	To perform smart tasks like humans	To make predictions or decisions from data
Needs Data?	Sometimes (uses data to act smartly)	Always (needs data to learn)
Human-Like Behavior	Yes (like speaking, seeing, or understanding)	No (just learns patterns)
Real-Life Example	Chatbot on JazzCash that replies to customers	App that predicts electricity usage next week

Machine Learning

Q.2 What are the two main types of Machine Learning? Explain.

Ans. ★ *Key Points: Supervised Learning | Unsupervised Learning*

Machine learning can be broadly classified into two main types: Supervised Learning and Unsupervised Learning.

1. Supervised Learning

In supervised learning, the machine is given data with correct answers (labels). It learns by comparing its own guesses with the correct answers and its learning improves over the time.

Definition: Supervised learning is when the machine is trained using labeled data, where both instance and correct output are provided.

Example 1: Suppose you are training a machine to predict whether a fruit is an apple or a mango. You show the machine many Apples and Mangoes and label it as that:

- "This is an Apple"
- "This is a Mango"

The computer learns and, later, can predict with high accuracy when shown pictures of apples and mangoes.

Example 2: A system can be trained based on marks and attendance of students to predict who might fail.

2. Unsupervised Learning

In unsupervised learning, the machine is given only data without any labels. It has to find patterns or group similar things by itself.

Definition: Unsupervised learning is when the machine finds patterns or groups in unlabeled data without being told what the correct answer is. This helps the store in marketing products in a better way, even without knowing the exact customer types.

Example: A school wants to divide students into study groups. The system checks their interests and subjects and forms groups just based on similarities and without knowing which group is "best".

3. Difference between Supervised and Unsupervised Learning

The difference between both types of learning is provided in the following table.

Feature	Supervised Learning	Unsupervised Learning
Labeled Data?	Yes (machine is told the correct answers)	No (machine finds patterns on its own)
Main Task	Predict or classify	Group or cluster similar data
Example	Predict student results using marks and study hours	Group customers based on shopping behavior
Uses in School	Identify students who need help	Make automatic student groups for projects

Applications of AI/ML

Q.3 What are the practical applications of AI and ML in daily life, and why is responsible use of these technologies important?

Ans. ★ *Key Points: Applications of AI | Applications of ML*

The applications of Artificial Intelligence (AI) and Machine Learning (ML) are given below:

1. Smart Assistants and Recommendations

AI powers many smart tools and apps that help make our lives easier.

Smart Assistants: Smart assistants like Google Assistant, Siri, use AI to understand voice commands, translate languages, set reminders, and answer questions.

Example: Say "Kal 8 bajay mujhe jagana" to Google Assistant in Urdu, it will set an alarm using speech recognition and Natural Language Processing (NLP) techniques, both powered by AI.

Recommendation systems (Using Past History or Activities): These systems suggest what you might like, based on your past activities.

Examples

- YouTube recommends videos after you watch a few clips.
- Shopping apps suggests clothes based on your browsing history.
- Instagram shows videos similar to what you have watched before.

These apps use ML to analyze what you like and improve their suggestions over time.

2. Business Use Cases Using Customer Analysis and Chatbots

AI help businesses understand customers, answer questions, and improve their services.

Customer Analysis: Companies collect data about customers to find:

- Which product is best to sell.

Example: A grocery delivery app like Cheetay uses ML to suggest items you often buy, and predicts which items are needed in which city.

Chatbots and Automated Help: Many Pakistani banks, telecoms, and e-commerce sites now use chatbots which are smart systems that can answer questions without needing a human agent. These chatbots use AI to understand typed questions and respond automatically.

DID YOU KNOW?

Q. How does AI benefit businesses?

Ans. AI helps businesses work faster, save money, and keep customers happy using the power of data.

3. Bias, Privacy, and Responsibility

While AI is powerful, they must be used responsibly.

Bias in AI: Sometimes, machines learn unfair patterns from the data they are trained on. This is called bias.

Example: If an AI system is trained only on English or male voices, it may not work well with Urdu speakers or female voices.

4. Privacy and Data Use

AI systems often use personal data (like name, location, or choices) which raises privacy concerns. For example, if an app tracks your movements or listens to your microphone without permission, it can be misused.

5. Best Practice

- Ask for user permission
- Protect data using encryption

- Do not collect more than needed

6. Responsibility of Humans

Humans must use AI wisely as it is just a tool. If an AI powered system makes a wrong decision, the responsibility lies with the humans who created or used it. Example: If a facial recognition system wrongly accuses someone, the system should be fixed and detected/corrected.

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Supervised & Unsupervised Algorithms

Q.4 What are supervised and unsupervised algorithms, and how do common data science algorithms work?

10506004

Ans. ★ Key Points: *Supervised Algorithms | Unsupervised Algorithms*

1. Supervised and Unsupervised Algorithms

Data science uses various algorithms to find patterns, make predictions, or analyze large data. Choosing the right algorithm depends on the type of data and the kind of problem you are trying to solve.

2. Common Data Science Algorithms

Some common data science algorithms are:

- Linear Regression: Predicts future values based on a straight-line relationship (e.g., predicting student scores from study hours).
- Decision Trees: Uses a tree-like model to make decisions based on yes/no questions (e.g., predicting if a customer will buy or not).
- K-Means (Clustering): Groups similar items together (e.g., grouping students with similar interests).

These algorithms help organizations solve real-world problems such as predicting exam results, grouping customers for better marketing and identifying patterns in fraud or health data.

DID YOU KNOW?

Q. How can algorithm be explained using a kitchen recipe example?

Ans. An algorithm is like a recipe in the kitchen. It tells the computer what ingredients (data) to use and the step-by-step instructions to follow in order to produce the final dish, such as a prediction or a group.

Q.5 What is Linear Regression, and how can it be used to predict student test scores based on study hours?

10506005

Ans. ★ Key Points: *Linear Regression | Example of Linear Regression*

Linear Regression

Simple linear regression algorithm helps us predict a value based on the relationship between two things. For example, a teacher wants to predict how well students will perform in a test based on the number of hours they studied. Here, study hours are taken as Input (X) while test score are used as Output (Y). Linear regression finds a line that best fits the data and helps predict marks if students studied for, say, 6 hours. Predicting sales, temperature, or student performance based on past data are among the few use cases of linear regression.

Scenario: A teacher wants to predict student test scores based on their study hours using data.

Study Hours	Test Scores
01	35
02	40
03	45
04	50
05	55
06	60
07	65
08	70
09	75

Study Hours	Test Scores
10	80

Students Data

Linear Regression draws a best-fit straight line to predict future values provided in the above table. In a graph of Study Hours (X-axis) vs Test Scores (Y-axis), the dots represent actual student scores while the line shows the predicted trend. If a student studies for 6.5 hours, the model can predict their score using the line — roughly midway between the scores for 6 hours (60) and 7 hours (65), i.e. about 62-63.

DID YOU KNOW?

Q. What is the key difference between simple and multiple linear regression? (10506005a)

Ans. Simple linear regression uses one independent variable to predict an outcome, while multiple linear regression uses more than one independent variable to predict an outcome.

Evaluating Model Performance

Q.6 What is a confusion matrix, and how is accuracy calculated to evaluate the performance of a machine learning model? 10506006

OR Explain how model performance is evaluated in machine learning using the following metrics: a) Confusion Matrix b) Accuracy

Ans. ★ Key Points: Model Performance | Confusion Matrix

1. Evaluating Model Performance

Once a ML model is trained, (like predicting who will buy a product or whether a message is spam), then we are required to measure the performance of the model. This helps to make decision if the model is accurate and reliable.

2. Confusion Matrix

A confusion matrix is a table used to evaluate a classification model by showing how many predictions were correct or incorrect. The following table shows a simple confusion matrix considering whether a student will pass or fail (classification problem).

	Predicted: Pass	Predicted: Fail
Actual: Pass	True Positive (TP)	False Negative (FN)
Actual: Fail	False Positive (FP)	True Negative (TN)

Confusion Matrix

- True Positive (TP): Model predicted pass, and the student actually passed.
- True Negative (TN): Model predicted fail, and the student actually failed.
- False Positive (FP): Model predicted pass, but the student actually failed.
- False Negative (FN): Model predicted fail, but the student actually passed.

3. Accuracy

Accuracy (A) tells us how many predictions were correct out of all the predictions made. It is calculated as follows:

$$\text{Accuracy} = (TP + TN) / (TP + TN + FP + FN)$$

Let us assume that we have data for 15 students. In actual, 8 students were pass while 7 failed. The model produced the following results:

- TP = Correctly predicted pass = 7
- TN = Correctly predicted fail = 5
- FP = Wrongly predicted pass = 2
- FN = Wrongly predicted fail = 1

Using the above formulas and model results, we calculate accuracy as follows:

$$\begin{aligned}\text{Accuracy} &= (TP + TN) / (TP + TN + FP + FN) \\ &= (7 + 5) / (7 + 5 + 2 + 1) \\ &= 12 / 15 \\ &= 0.80 \text{ or } 80\%\end{aligned}$$

TOPIC WISE SHORT QUESTIONS (ADDITIONAL)

Overview of AI and ML

Q.1 What is AI?

Ans. AI means teaching machines to do tasks that usually require human intelligence such as understanding speech, recognizing images, or making decisions.

Q.2 What is ML?

Ans. Machine Learning (ML) is a part of AI. It means training a machine to learn from data and make decisions on its own without being programmed every time.

Q.3 What is AI used in real life?

Ans. AI is widely used in real life applications such as understanding speech, recognizing images, or making decisions, or making decisions and images, used in real-life applications like Alexa, and Google Assistant help users perform tasks using voice commands.

Q.4 Give examples of ML.

Ans. Machine Learning (ML) is used in many real-life applications. For example, Netflix and YouTube recommend videos based on a user's watching history. Similarly, weather apps predict future weather using past temperature data. It is also used in Urdu speech-to-text applications and chatbots in banks such as HBL and traffic control systems in cities like Lahore.

Q.5 What is the difference between AI and ML?

Ans. AI is the broader concept of making machines smart enough to mimic human behavior, while ML is the process of teaching machines to learn from data and improve. AI's main goal is to perform smart tasks like humans, whereas ML's goal is to make predictions or decisions from data.

Q.6 How are AI and ML related?

Ans. Think of AI as the brain, and ML as the experience that teaches the brain how to improve. AI is the broader concept of machines acting smart, while ML is when machines learn from data to make predictions or decisions.

Machine Learning Types

Q.7 What is Supervised Learning?

Ans. Supervised learning is a type of machine learning in which the machine is trained using labeled data. In this approach, each input comes with the correct output, and the model learns to map inputs to outputs accurately.

Q.8 Give any two examples of Supervised Learning.

Ans. Example 1: Supervised learning includes predicting whether a fruit is an apple or a mango using labelled images, where the correct fruit name is already known. Example 2: Predict which students might fail based on labelled data such as their marks and attendance records.

Q.9 What is Unsupervised Learning?

Ans. Unsupervised learning is a type of machine learning in which the machine discovers patterns, relationships, or groups in unlabelled data without being given the correct output.

Q.10 Give examples of Unsupervised Learning.

Ans. Unsupervised learning examples include dividing students into study groups based on interests and grouping products in a store without knowing customer types.

Q.11 What is the difference between Supervised and Unsupervised Learning?

Ans. Supervised learning uses labelled data to predict or classify and is like learning with a teacher, while unsupervised learning uses unlabelled data to find hidden patterns and is like exploring on your own.

Practical Applications of AI/ML

Q.12 Where do we use AI and ML in daily life? 10506018

Ans. AI and ML are used in smart assistants, recommendation systems, shopping apps, and chatbots to make life easier and faster.

Q.14 Give an example of a smart assistant in action. 10506020

Ans. Saying "Kal 8 bajay mujhe jagana" to Google Assistant sets an alarm using speech recognition and natural language processing powered by AI.

Q.16 Give some examples of recommendation systems.

Ans. YouTube recommends videos based on what you watched. Daraz suggests clothes based on browsing history. Instagram shows videos similar to what you have watched.

Q.18 Give a business example using AI.

Ans. Cheetay uses ML to suggest grocery items people often buy and predicts which items are needed in each city.

Q.20 What is bias in AI?

Ans. AI bias (also called machine learning or algorithm bias) happens when an AI gives unfair results because the training data or the algorithm reflects human biases. This can lead to wrong or harmful outcomes.

Q.22 Who is responsible for AI decisions? 10506028

Ans. Humans are responsible for AI decisions; if an AI system makes a wrong decision, humans must fix it.

Q.13 What are Smart Assistants? 10506019

Ans. Smart assistants like Google Assistant and Siri use AI to understand voice commands, translate languages, set reminders, and answer questions.

Q.15 What are Recommendation Systems? 10506021

Ans. Recommendation systems suggest content or products based on past activities using ML to improve suggestions over time.

Q.17 How is AI used in business? 10506023

Ans. AI helps businesses analyze customer data, suggest products, improve services, and automate customer support using chatbots.

Q.19 What are chatbots and how do they use AI? 10506025

Ans. Chatbots are smart systems that answer typed questions automatically using AI without needing a human agent.

Q.21 How can we protect privacy with AI? 10506027

Ans. We can protect privacy with AI by asking for user permission, securing data using encryption, and collecting only the data that is necessary.

Q.23 What is the use of AI in daily life and business? 10506029

Ans. AI is used in smart assistants, shopping apps, and chatbots; businesses use it for customer service and sales analysis; humans must consider fairness, privacy, and responsibility.

Supervised and Unsupervised Algorithms

Q.24 What is a data science algorithm? 10506030

Ans. A data science algorithm is a set of steps or rules that helps find patterns, make predictions, or analyze large data.

Q.26 How can we think of an algorithm? 10506032

Ans. An algorithm is like a recipe: it tells the computer what ingredients (data) to use and what steps to follow to get the final result (prediction or group).

Q.28 How does Linear Regression make predictions? 10506034

Ans. It draws a line that best fits the data points and predicts values based on that line.

Q.30 Write example scenario for Linear Regression. 10506036

Ans. A teacher wants to predict student scores using study hours. The model uses past data points to draw a best-fit line; if a student studies for 6.5 hours, the score can be predicted using the line.

Q.25 Write examples of common data science algorithms. 10506031

Ans. Common data science algorithms include Linear Regression, which predicts future values; Decision Trees, which make decisions using yes/no questions; and K-Means Clustering, which groups similar items together.

Q.27 What is Linear Regression? 10506033

Ans. Linear Regression is a technique used to predict a value based on the relationship between two variables (input and output). Example: Predicting student test scores based on study hours.

Q.29 What is Multiple Linear Regression? 10506035

Ans. Multiple Linear Regression is a technique that uses more than one input variable to predict an outcome and improve prediction accuracy.

Evaluating Model Performance

Q.31 Why do we measure ML model performance? 10506037

Ans. We measure ML model performance to determine whether the model is accurate and reliable for making predictions or classifications.

Q.33 Define the terms in a Confusion Matrix. 10506039

Ans. TP (True Positive): Predicted pass, actually pass. TN (True Negative): Predicted fail, actually fail. FP (False Positive): Predicted pass, actually fail. FN (False Negative): Predicted fail, actually pass.

Q.35 What is Accuracy in ML? 10506041

Ans. Accuracy tells us how many predictions were correct out of all predictions made.

Q.32 What is a Confusion Matrix? 10506038

Ans. A confusion matrix is a table that shows how many predictions were correct or incorrect for a classification problem.

Q.34 What does a Confusion Matrix help with? 10506040

Ans. It helps understand whether a model is making mistakes and is used to calculate accuracy.

Q.36 How is Accuracy calculated? 10506042

Ans. Accuracy is calculated using the formula: $\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$. Example: TP=7, TN=5, FP=2, FN=1 $\rightarrow A = 12/15 = 0.80$ or 80%.

TOPIC WISE MULTIPLE CHOICE QUESTIONS (ADDITIONAL)

Overview of AI and ML

1. What does AI stand for? 10506043

- (a) Automated Interaction
- (b) Advanced Integration
- (c) Automatic Instruction
- (d) Artificial Intelligence

2. Which of the following is an example of AI in real life? 10506044

- (a) Weather app
- (b) Chatbot used by banks
- (c) Handwritten letter
- (d) Electricity prediction

3. What is the main goal of Artificial Intelligence (AI)? 10506045

- (a) Perform smart tasks
- (b) Predict from data
- (c) Collect data
- (d) Program machines

4. How does Machine Learning (ML) differ from AI? 10506046

- (a) Mimics humans
- (b) Always needs data
- (c) Broader than AI
- (d) Only for chatbots

5. Which statement best defines Machine Learning (ML)? 10506047

- (a) Mimic humans
- (b) Understand speech/images
- (c) Manual programming
- (d) Learn from data

6. Which of the following is a real-life example of Machine Learning (ML)? 10506048

- (a) Lahore traffic system
- (b) Hbl chatbot
- (c) Netflix recommendation
- (d) Urdu speech-to-text

7. AI can be thought of as ____ and ML as _____. 10506049

- (a) Experience; Brain
- (b) Data; Prediction
- (c) Brain; Experience
- (d) Robot; Human

8. Which feature is true for AI but not for ML? 10506050

- (a) Human-like behavior
- (b) Needs data
- (c) Predicts from data
- (d) Learns patterns

9. In simple terms, AI can be described as: 10506051

- (a) Needs programming
- (b) Thinks & acts like humans
- (c) Only predicts patterns
- (d) Only stores data

Machine Learning Types

10. What is supervised learning? 10506052 (a) Without labels (b) With labels (c) Grouping data (d) Predicting patterns	11. Which is an example of supervised learning? 10506053 (a) Predicting pass/fail (b) Grouping students (c) Grouping products (d) Clustering customers
12. How does supervised learning improve performance? 10506054 (a) Explore patterns (b) Guess randomly (c) Compare with correct answers (d) Form groups	13. What is unsupervised learning? 10506055 (a) Learn from data (b) With correct answers (c) From labeled data (d) Predict outcomes
14. Which of the following is an example of unsupervised learning? 10506056 (a) Group students (b) Predict marks (b) Spam detection (d) Apple vs mango (c) (d)	15. Grouping customers without knowing types is: 10506057 (a) Supervised (b) Unsupervised (c) Both (d) Neither
16. Supervised learning learns: 10506058 (a) With answers (b) Without labels (c) By guessing (d) By clustering	17. Which fits supervised learning? 10506059 (a) Group customers (b) Group students (c) Cluster products (d) Identify apples/mangoes

Practical Applications of AI/ML

18. What do smart assistants like Google Assistant and Siri use AI for? 10506060

- (a) Make calls only
- (b) Understand voice & answer
- (c) Store files
- (d) Play videos only

19. Which example shows AI helping with reminders using voice in Urdu? 10506061

- (a) Saying "kal 8 bajay mujhe jagana" to google assistant
- (b) Typing a search in google
- (c) Sending an email
- (d) Taking a photo

20. The recommendation systems like YouTube, Daraz, or Instagram use ML to: 10506062

- (a) Make phone calls
- (b) Analyze past activities & suggest
- (c) Write emails
- (d) Store files

21. How does AI help businesses with customer analysis? 10506063

- (a) Stores invoices
- (b) Replaces employees
- (c) Designs buildings
- (d) Predicts best-selling products

22. Which of these is an example of AI chatbots in Pakistan? 10506064

- (a) Banks answering questions automatically
- (b) Manual cash counters
- (c) Grocery delivery drivers
- (d) Traffic lights

23. What is bias in AI? 10506065

- (a) Storing data safely
- (b) Machines learning unfair patterns
- (c) Improving predictions
- (d) Translating languages

24. How can bias in AI be reduced? 10506066

- (a) Use diverse & balanced data
- (b) Delete all data
- (c) Avoid predictions
- (d) Collect random data

25. What is a key privacy concern with AI systems? 10506067

- (a) Understanding voice
- (b) Making predictions
- (c) Tracking personal data without permission
- (d) Recommending videos

26. Who is responsible if an AI system makes a wrong decision? 10506068

- (a) The machine
- (b) Humans who created/used it
- (c) The user only
- (d) The internet

27. Which of the following summarizes ethical use of AI? 10506069

- (a) Fairness, Privacy, Responsibility
- (b) Speed, Cost, Power
- (c) Randomness, Guessing, Storing data
- (d) Games, Videos, Music

Supervised and Unsupervised Algorithms

28. What is the main purpose of data science algorithms?

10506070

- (a) Store data
- (b) Find patterns & predict
- (c) Write emails
- (d) Play videos

29. Linear regression predicts future values based on:

10506071

- (a) A straight-line relationship
- (b) Random guessing
- (c) Tree-like decisions
- (d) Clustering items

30. Which of the following is an example of linear regression? 10506072

- (a) Deciding if a customer will buy
- (b) Grouping students by interests
- (c) Predicting student scores from study hours
- (d) Clustering products

31. The decision trees are used to: 10506073

- (a) Predict values from past data
- (b) Make decisions based on yes/no questions
- (c) Group similar items
- (d) Store large data

32. The K-means clustering helps to: 10506074

- (a) Predict future values
- (b) Make yes/no decisions
- (c) Group similar items
- (d) Write programs automatically

33. In linear regression, the input is called: 10506075

- (a) Output
- (b) Independent variable
- (c) Dependent variable
- (d) Cluster

34. In the student score scenario, what does the line in the graph represent? 10506076

- (a) Actual student scores
- (b) Errors in data
- (c) Predicted trend
- (d) Random points

35. The multiple linear regression is used when: 10506077

- (a) Outcomes depend on many factors
- (b) Only one input exists
- (c) Data is unlabeled
- (d) Clustering is needed

36. A simple analogy for an algorithm in data science is:

10506078

- (a) A computer screen
- (b) A recipe guiding steps
- (c) A teacher grading students
- (d) A calculator

Evaluating Model Performance

37. Why do we measure the performance of a trained ML model? 10506079

- (a) To collect data
- (b) To decide if it is accurate & reliable
- (c) To write programs
- (d) To store predictions

38. What does a confusion matrix show? 10506080

- (a) Data storage
- (b) Only correct predictions
- (c) Only wrong predictions
- (d) Number of predictions & mistakes

39. In a confusion matrix, TP (True Positive) means: 10506081

- (a) Predicted pass, actually pass
- (b) Predicted pass, actually fail
- (c) Predicted fail, actually fail
- (d) Predicted fail, actually pass

40. In a confusion matrix, FN (False Negative) means: 10506082

- (a) Predicted pass, actually pass
- (b) Predicted fail, actually pass
- (c) Predicted pass, actually fail
- (d) Predicted fail, actually fail

41. How is accuracy calculated for a classification model? 10506083

- (a) TP / FN
- (b) $(TP + TN) / \text{Total}$
- (c) FP / TN
- (d) $TN - TP$

42. If $TP = 7$, $TN = 5$, $FP = 2$, $FN = 1$, what is the accuracy? 10506084

- (a) 50%
- (b) 60%
- (c) 80%
- (d) 90%

43. Which of the following is a use of confusion matrix? 10506085

- (a) To make linear regression
- (b) To find mistakes in predictions
- (c) To cluster data
- (d) To store datasets

44. The main purpose of TP, TN, FP, FN is to: 10506086

- (a) Calculate accuracy & analyze mistakes
- (b) Draw graphs
- (c) Collect new data
- (d) Predict outcomes without labels

Answers

1	2	3	4	5	6	7	8
d	b	a	b	d	c	c	a
9	10	11	12	13	14	15	16
b	b	a	c	c	a	b	a
17	18	19	20	21	22	23	24
d	b	a	b	d	a	b	a
25	26	27	28	29	30	31	32
c	b	a	b	a	c	b	c
33	34	35	36	37	38	39	40
b	c	a	b	b	d	a	b
41	42	43	44				
b	c	b	a				

SOLVED EXERCISE

Multiple Choice Questions

1. What is Artificial Intelligence (AI)? 10506087

- (a) Solving math problems by hand
- (b) Machines performing tasks like humans
- (c) Sending emails using a computer
- (d) Watching videos online

2. Which of the following is an example of AI? 10506088

- (a) A chatbot replying to your questions
- (b) Using a whiteboard
- (c) A TV remote
- (d) Typing on a keyboard

3. What is Machine Learning (ML)? 10506089

- (a) Teaching humans to use machines
- (b) Teaching machines to learn from data like human
- (c) Learning computer hardware basics
- (d) A machine without internet

4. Which app recommends videos using ML? 10506090

- (a) Google Maps
- (b) Microsoft Paint
- (c) YouTube
- (d) Windows Media Player

5. In supervised learning, the data is: 10506091

- (a) Unorganized
- (b) Without any answers
- (c) Labeled with correct answers
- (d) Only text-based

6. Which of the following is an example of unsupervised learning? 10506092

- (a) Predicting student marks
- (b) Identifying spam emails
- (c) Marking quizzes
- (d) Grouping students by interest without labels

7. Google Assistant is an example of: 10506093

- (a) A game app
- (b) A word processor
- (c) A smart assistant using AI
- (d) A calculator

8. AI is mostly used for: 10506094

- (a) Handwriting notes
- (b) Making phone calls
- (c) Charging phones
- (d) Smart decision making and automation

9. A chatbot on JazzCash is an example of: 10506095

- (a) Cloud computing
- (b) Data visualization
- (c) AI in business
- (d) Unsupervised Learning

Answers

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

Short Questions

Q.1 What is the difference between AI and ML? 10506096

Ans.

Term	Description
AI	AI is the broader concept of machines performing tasks like humans
ML	ML is a subset of AI where machines learn from data to make predictions or decisions

Q.2 Give one real-life example of AI used in Pakistan. 10506097

Ans. One real-life example of AI used in Pakistan is chatbots used on JazzCash or bank websites.

Q.3 How does supervised learning work? 10506098

Ans. In supervised learning, the machine is trained on labeled data, makes predictions, and compares them with the correct answers. Using this feedback, it adjusts and gradually improves its accuracy over time.

Q.4 Define confusion matrix. 10506099

Ans. A confusion matrix is a table that shows correct and incorrect predictions of a classification model using TP, TN, FP, and FN.

Q.5 How can businesses use AI? 10506100

Ans. Businesses use AI for customer analysis, chatbots, recommendations, and automating tasks to save time and improve services.

Q.6 Give one example each of a smart assistant and a recommendation system. 10506101

Ans. Smart assistant: Google Assistant. Recommendation system: YouTube video suggestions.

Q.7 What kind of data is used in unsupervised learning? 10506102

Ans. Unsupervised learning uses unlabeled, raw and unstructured data that does not have correct answers. It requires large diverse datasets such as images.

Q.8 Define Linear Regression. 10506103

Ans. See Short Question No. 27 (topic-wise): Linear Regression is a technique used to predict a value based on the relationship between two variables (input and output).

Long Questions

Q.1 Explain supervised and unsupervised learning with suitable examples. 10506104

Ans. See Long Question No. 2.

Q.2 Explain how model performance is evaluated in machine learning using the following metrics: (a)

Confusion Matrix (b) Accuracy 10506105

Ans. See Long Question No. 6.

Q.3 A model predicts if students will pass (1) or fail (0). Out of 20 students: True Positives (TP) = 8, True Negatives (TN) = 6, False Positives (FP) = 4, False Negatives (FN) = 2. You are required to (a) fill the confusion matrix, and (b) calculate accuracy. 10506106

Ans. Given Data

- Total students = 20
- TP = 8 (predicted pass, actually pass)
- TN = 6 (predicted fail, actually fail)
- FP = 4 (predicted pass, actually fail)
- FN = 2 (predicted fail, actually pass)

(a) Confusion Matrix

	Predicted: Pass	Predicted: Fail
Actual: Pass	TP = 8	FN = 2
Actual: Fail	FP = 4	TN = 6

Confusion matrix filled.

(b) Accuracy Calculation

$$\begin{aligned}
 \text{Accuracy} &= (TP + TN) / (TP + TN + FP + FN) \\
 &= (8 + 6) / (8 + 6 + 4 + 2) \\
 &= 14 / 20 \\
 &= 0.7 \text{ or } 70\%
 \end{aligned}$$

Confusion Matrix:

	Predicted: Pass	Predicted: Fail
Actual: Pass	8	2
Actual: Fail	4	6

Accuracy: 70%

SOLVED ACTIVITIES**Activity - 1: Discuss and Match (Supervised or Unsupervised Learning)**

Objective: Understand the difference between Supervised and Unsupervised Machine Learning by identifying the correct type for real-life situations.

Instructions:

- Read each situation below carefully.
- In your notebook, write the correct ML type for each: whether each situation is an application of supervised or unsupervised learning.
- Write your answers in your notebook with a brief reason for each.
- Discuss your answers with a classmate and groups.
- Explain your reasoning during class discussion.

Solution:

Sr.	Situation Statement	S/U	Reason
1	Predicting if a student will pass or fail	S	Supervised: The system uses labeled data (pass/fail) to learn.
2	Grouping students based on subject preferences	U	Unsupervised: No labels given, system finds patterns or similarities.
3	Identifying spam emails from inbox	S	Supervised: System learns from labeled emails (spam or not spam).
4	Dividing products into types based on features	U	Unsupervised: System groups products based on similarities without labels.

Activity - 2: AI in Our Daily Life

Objective: Recognize how AI and ML are used in everyday tools and applications.

Instructions:

- List 3 Apps you have used during previous week that may use AI. For example, YouTube, Google Maps, ChatGPT, Snapchat.
- With a class partner, discuss what the AI does in each app. Does it suggest videos? Does it respond to voice commands? Does it help you search faster?
- Write your examples and the AI Role in your notebook.

Solution:

Example: Three Apps and Their AI Roles

App	AI Role / Function
YouTube	Suggests videos based on what you watched before (Recommendation system using ML)
Google Maps	Gives fastest routes, predicts traffic, responds to voice commands (AI + ML)
ChatGPT	Understands typed questions and gives answers (AI using natural language processing)

Step 1: List 3 Apps

Choose three apps you used last week that likely use AI:

- YouTube
- Google Maps
- ChatGPT

Step 2: Identify What AI Does in Each App

- YouTube: AI suggests videos based on your watch history and interests.
- Google Maps: AI finds the fastest routes, predicts traffic, and gives directions.
- ChatGPT: AI answers questions, generates text, and helps with tasks.

Step 3: Discuss with a Partner

Talk about:

- How each app uses AI?
- Whether it recommends content, understands voice, or improves search
- Share your experiences using these apps

Step 4: Write in Your Notebook

Write your examples like this:

- App Name → AI Role
- YouTube → Suggests videos
- Google Maps → Shows best routes and traffic
- ChatGPT → Answers questions and gives information

This completes your activity step by step.