Q1. Explain the following with an example

(a) Artificial Intelligence (AI)

Artificial Intelligence is a broad field that focuses on creating machines that can **simulate human intelligence**, such as reasoning, learning, and decision-making.

Example:
A chess-playing computer or a voice assistant like Siri.

(b) Machine Learning (ML)

Machine Learning is a subset of AI that allows systems to **learn from data without being explicitly programmed**.

Example:
Email spam filtering based on past spam emails.

(c) Deep Learning (DL)

Deep Learning is a subset of machine learning that uses **neural networks with multiple layers** to learn complex patterns.

Example:
Face recognition systems in smartphones.

Q2. What is supervised learning? Give examples

Supervised learning is a type of machine learning where the model is trained on **labeled data** (input with known output).

Examples

- Email spam detection
- House price prediction

- Medical diagnosis
- Credit risk prediction

Q3. What is unsupervised learning? Give examples

Unsupervised learning deals with **unlabeled data**, where the model discovers patterns or structure on its own.

Examples

- Customer segmentation
- Market basket analysis
- Anomaly detection
- Topic modeling

Q4. Difference between AI, ML, DL, and DS

Aspect	AI	ML	DL	DS
Full form	Artificial Intelligence	Machine Learning	Deep Learning	Data Science
Scope	Broad	Subset of AI	Subset of ML	Interdisciplinary
Data use	May not require data	Requires data	Requires large data	Uses data
Example	Game playing	Spam filter	Image recognition	Business analytics

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Q5. Differences between supervised, unsupervised, and semi-supervised learning

Feature	Supervised	Unsupervised	Semi-Supervised
Data	Labeled	Unlabeled	Few labeled + many unlabeled
Output known	Yes	No	Partially
Example	Classification	Clustering	Image classification with few labels

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Q6. Train, test, and validation split

Dataset	Purpose
Training set	Used to train the model
Validation set	Used to tune hyperparameters
Test set	Used to evaluate final performance

Importance

- Prevents overfitting
- Ensures unbiased model evaluation

Q7. Unsupervised learning in anomaly detection

Unsupervised learning identifies **patterns that differ significantly from normal behavior**.

Examples

- Fraud detection
- Network intrusion detection
- Manufacturing defect detection

Algorithms used

- K-Means clustering
- Isolation Forest
- Autoencoders

Q8. Common supervised and unsupervised learning algorithms

Supervised Learning Algorithms

- Linear Regression
- Logistic Regression
- Decision Trees
- Random Forest
- Support Vector Machine (SVM)
- K-Nearest Neighbors (KNN)
- Naive Bayes

Unsupervised Learning Algorithms

- K-Means Clustering
- Hierarchical Clustering
- DBSCAN
- Principal Component Analysis (PCA)

- Apriori Algorithm
- Autoencoders
