

1. Define Machine Learning.
2. What is the need of Machine Learning.
3. Write the applications of Machine Learning
4. Demonstrate machine learning process with an example.
5. What is the difference between linear regression and logistic regression.
6. Elaborate different types of machine learning mechanisms.
7. What is the difference between supervised and unsupervised learning.
8. What is the difference between classification and regression.
9. Differentiate between Feedback networks and Feed Forward networks?
10. List the limitations of the perception model.
11. How to compute error in a neural network.
12. Differentiate between Feedback networks and Feed Forward networks?
13. Explain Multi-Layer Networks with Non-Linear Units
14. Apply at least 3 activation functions to a hidden node in an artificial neural network and calculate the output of the hidden node. Use suitable input and parameters data.
15. Explain the importance of the activation function in an artificial neural network with relevant diagrams.
16. Differentiate between Feature selection methods and Feature Extraction methods?
17. Define Dimensionality reduction and list its advantages.
18. List different Dimensionality reduction techniques.
19. Differentiation between LDA and PCA?
20. Explain how to calculate S_B and S_W
21. Define LDA and list its advantages and disadvantages.
22. Problems computing Eigen Values and Eigen Vectors when a Covariance matrix.
23. Problems computing covariance matrix for a given datasets.
24. Compare and contrast PCA.
25. List the features of PCA.
26. Write and explain PCA.

27. Academics carried out a study on 50 former United States presidents and found an average IQ of 135. You are required to carry out a 5% statistical test to determine whether the average IQ of presidents is greater than 130. (IQs are distributed normally, and previous studies indicate that $\sigma = 25$.)

28. What is Hypothesis testing? Explain the Process of Hypothesis testing.

29. Describe the concept of Sampling and Sampling Distribution.

30. The annual rate of rainfall (cm) in a certain equatorial country over the last 10 years is given below: {25, 26, 25, 27, 28, 29, 28, 27, 26, 25}

Financial analysts in the country wish to determine whether the average rate of rainfall has increased from its former value of 23. Carry out a statistical test at the 5% level.

31. A rowing team consists of four rowers who weigh 152, 156, 160, and 164 pounds. Find all possible random samples with replacement of size two and compute the sample mean for each one. Use them to find the probability distribution, the mean, and the standard deviation of the sample mean.

32. Suppose a genetic algorithm uses chromosomes of the form $x = abcdefgh$ with a fixed length of eight genes. Each gene can be any digit between 0 and 9. Let the fitness of individual x be calculated as: $f(x) = (a + b) - (c + d) + (e + f) - (g + h)$, and let the initial population consist of four individuals with the following chromosomes:

$$x_1 = 6\ 5\ 4\ 1\ 3\ 5\ 3\ 2$$

$$x_2 = 8\ 7\ 1\ 2\ 6\ 6\ 0\ 1$$

$$x_3 = 2\ 3\ 9\ 2\ 1\ 2\ 8\ 5$$

$$x_4 = 4\ 1\ 8\ 5\ 2\ 0\ 9\ 4$$

a) Evaluate the fitness of each individual, showing all your workings, and arrange them in order with the fittest first and the least fit last.

b) Perform the following crossover operations:

i) Cross the fittest two individuals using one-point crossover at the middle point.

ii) Cross the second and third fittest individuals using a two-point crossover (points b and f).

iii) Cross the first and third fittest individuals (ranked 1st and 3rd) using a uniform crossover.

33. A budget airline company operates 3 planes and employs 5 cabin crews. Only one crew can operate on any plane in a single day, and each crew cannot work for more than two days in a row. The company uses all planes every day. A Genetic Algorithm is used to work out the best combination of crews on any day.

a) Suggest what chromosome could represent an individual in this algorithm?

b) Suggest what could be the alphabet of this algorithm? What is its size?

c) Suggest a fitness function for this problem.

- d) How many solutions are in this problem? Is it necessary to use Genetic Algorithms for solving it? What if the company operated more planes and employed more crews?

34. Define Type I and Type II errors in the context of hypothesis testing.

35. (a) Briefly outline the major steps of Decision tree classifier
 (b) Explain Inductive Bias in Decision Tree Learning.
 (c) Discuss on Machine learning system with a schematic diagram

(Or)

36. (a) For the game of checkers, Model the learning system
 (b) By using the decision tree classification algorithm construct the decision tree

Age	Income	Student	Credit_Rating	Buy Computer
<=30	High	No	Fair	No
<=30	High	No	Excellent	No
31....40	High	No	Fair	Yes
>40	Medium	No	Fair	Yes
>40	Low	Yes	Fair	Yes
>40	Low	Yes	Excellent	No

37. (a) Explain Bayesian Belief Net? Where are they used? Can it solve all type of problems?
 (b) Write K-nearest neighbor learning algorithm for continuous valued target function.
38. Generate all possible clusters for the given dataset following data { 5, 11, 19, 27, 23, 25, 6, 18, 2, 8, 10, 12, 31, 29, 4} by using the clustering algorithm
39. (a) Discuss Multilayer perceptron? How is it trained using Back propagation?
 (b) Describe the Genetic Algorithm (GA) steps using the Population, Fitness function, other necessary data and hypothesis it returns
40. (a) Explain back propagation algorithm and derive expressions for weight update relations.
 (b) Discuss different types of crossovers.