



Question 1:

- a) Explain the concept of linear regression. Define the objective function and the method used to minimize it. Discuss the role of linear algebra in solving the linear regression problem.
- b) Provide an example illustrating how linear regression is applied in machine learning. Describe the steps involved in training a linear regression model.

Question 2:

- a) Define the concept of probability and its role in machine learning. Explain the difference between probability mass function (PMF) and probability density function (PDF). Provide an example of calculating probabilities using these functions.
- b) Discuss the concept of maximum likelihood estimation (MLE). Explain how MLE is used to estimate the parameters of a probabilistic model.

Question 3:

- a) Explain the concept of gradient descent optimization. Discuss the steps involved in performing gradient descent and how the learning rate affects the convergence of the algorithm.
- b) Provide an example illustrating the use of gradient descent in training a machine learning model. Discuss the challenges and potential issues associated with gradient descent.

Question 4:

- a) Define the concept of matrix factorization. Discuss its applications in collaborative filtering and recommendation systems. Explain the matrix factorization algorithm and how it is used to make predictions.
- b) Discuss the concept of singular value decomposition (SVD) and its relationship with matrix factorization. Explain the steps involved in performing SVD and its significance in dimensionality reduction.

Question 5:

- a) Explain the concept of support vector machines (SVM) and the role of kernel functions in SVM. Discuss different types of kernel functions and their impact on the decision boundary.
- b) Provide an example illustrating the use of SVM for binary classification. Discuss the advantages and limitations of SVM.