**Non-programming Assignment**

1. **What are underfitting and overfitting?**

**Underfitting** occurs when the model is too simple to capture the data patterns, resulting in poor performance on both training and test data. **Overfitting** happens when the model learns the training data too well, including noise, leading to poor generalization on new data.

1. **What may cause early stopping of the gradient descent optimization process?**

Early stopping can be triggered when the validation error starts increasing even though the training error continues to decrease, signalling overfitting.

1. **Describe the recognition bias vs variance and their relationship.**

**Bias** refers to errors introduced by oversimplifying the model, while **variance** refers to sensitivity to fluctuations in training data. The **bias-variance trade-off** is a balancing act to avoid underfitting (high bias) and overfitting (high variance).

1. **Describe regularization as a method and the reasons for it.**

**Regularization** adds a penalty to the loss function (e.g., L1 or L2 regularization) to constrain large weights, thus preventing overfitting by making the model simpler.

1. **Describe dropout as a method and the reasons for it.**

**Dropout** randomly "drops" neurons during training, forcing the network to learn robust features. This technique reduces overfitting and improves generalization by preventing co-adaptation of neurons.