1. Describe the structure of an artificial neuron. How is it similar to a biological neuron? What are its main components?

ANS:

Artificial neuron also known as perceptron is the basic unit of the neural network. In simple terms, it is a mathematical function based on a model of biological neurons. It can also be seen as a simple logic gate with binary outputs. They are sometimes also called perceptrons.

1. What are the different types of activation functions popularly used? Explain each of them.

ANS:

Simply put, an activation function is a function that is added into an artificial neural network in order to help the network learn complex patterns in the data. When comparing with a neuron-based model that is in our brains, the activation function is at the end deciding what is to be fired to the next neuron

* 1. Explain, in details, Rosenblatt’s perceptron model. How can a set of data be classified using a simple perceptron?

ANS:

Rosenblatt perceptron is a binary single neuron model. The inputs integration is implemented through the addition of the weighted inputs that have fixed weights obtained during the training stage. If the result of this addition is larger than a given threshold θ the neuron fires.

The Perceptron is a linear classification algorithm. This means that it learns a decision boundary that separates two classes using a line (called a hyperplane) in the feature space

* 1. Use a simple perceptron with weights w0, w1, and w2 as −1, 2, and 1, respectively, to classify data points (3, 4); (5, 2); (1, −3); (−8, −3); (−3, 0).

ANS:

 What are the values of weights wo, wl, and w2 for the perceptron whose decision surface isillustrated in Figure 4.3? Assume the surface crosses the xl axis at -1, and the x2 axis at 2. Ans. The function of the decision surface is: 2+2x1-x2 = 0, so w0 =2, w1 = 2, w2 = -1.

The first step in the perceptron classification process is calculating the weighted sum of the perceptron's inputs and weights. To do this, multiply each input value by its respective weight and then add all of these products together.

1. Explain the basic structure of a multi-layer perceptron. Explain how it can solve the XOR problem.

ANS:

The XOR problem with neural networks can be solved by using Multi-Layer Perceptrons or a neural network architecture with an input layer, hidden layer, and output layer. So during the forward propagation through the neural networks, the weights get updated to the corresponding layers and the XOR logic gets executed.

1. What is artificial neural network (ANN)? Explain some of the salient highlights in the different architectural options for ANN.

ANS:

The XOR problem with neural networks can be solved by using Multi-Layer Perceptrons or a neural network architecture with an input layer, hidden layer, and output layer. So during the forward propagation through the neural networks, the weights get updated to the corresponding layers and the XOR logic gets executed.

1. Explain the learning process of an ANN. Explain, with example, the challenge in assigning synaptic weights for the interconnection between neurons? How can this challenge be addressed?

ANS:

Basically, learning means to do and adapt the change in itself as and when there is a change in environment. ANN is a complex system or more precisely we can say that it is a complex adaptive system, which can change its internal structure based on the information passing through it.

Artificial Neural Networks (ANN) are algorithms based on brain function and are used to model complicated patterns and forecast issues. The Artificial Neural Network (ANN) is a deep learning method that arose from the concept of the human brain Biological Neural Networks.

1. Explain, in details, the backpropagation algorithm. What are the limitations of this algorithm?

ANS:

The disadvantages of using a backpropagation algorithm are as follows: It prefers a matrix-based approach over a mini-batch approach. Data mining is sensitive to noise and irregularities. Performance is highly dependent on input data.

1. Describe, in details, the process of adjusting the interconnection weights in a multi-layer neural network.

ANS:

Learning, in artificial neural network, is the method of modifying the weights of connections between the neurons of a specified network. Learning in ANN can be classified into three categories namely supervised learning, unsupervised learning, and reinforcement learning.

1. What are the steps in the backpropagation algorithm? Why a multi-layer neural network is required?

ANS:

According to the paper from 1989, backpropagation: repeatedly adjusts the weights of the connections in the network so as to minimize a measure of the difference between the actual output vector of the net and the desired output vector.

1. Write short notes on:
   * + 1. Artificial neuron

ANS:

An artificial neuron is a connection point in an artificial neural network. Artificial neural networks, like the human body's biological neural network, have a layered architecture and each network node (connection point) has the capability to process input and forward output to other nodes in the network.

* + - 1. Multi-layer perceptron

ANS:

A multilayer perceptron (MLP) is a feed forward artificial neural network that generates a set of outputs from a set of inputs. An MLP is characterized by several layers of input nodes connected as a directed graph between the input nodes connected as a directed graph between the input and output layers

* + - 1. Deep learning

ANS:

Deep learning is a method in artificial intelligence (AI) that teaches computers to process data in a way that is inspired by the human brain. Deep learning models can recognize complex patterns in pictures, text, sounds, and other data to produce accurate insights and predictions.

* + - 1. Learning rate

ANS:

Learning rate (λ) is one such hyper-parameter that defines the adjustment in the weights of our network with respect to the loss gradient descent. It determines how fast or slow we will move towards the optimal weights.

1. Write the difference between:-
   * + 1. Activation function vs threshold function

ANS:

A threshold value determines whether a neuron should be activated or not activated in a binary step activation function. The activation function compares the input value to a threshold value. If the input value is greater than the threshold value, the neuron is activated

* + - 1. Step function vs sigmoid function

ANS:

The step-function output is y = 1 if x ≥ θ , 0 if x ≤ θ . The sigmoid function, more commonly used, is asymptotic to 0 and 1 [83] and antisymmetric about (0, 0.5): 1 g ( x ) = , β> 0 1 + e − βx ANNs may be feedforward (the commonest) or feedback.

* + - 1. Single layer vs multi-layer perceptron

ANS:

In general, a single-layer perceptron is more suitable for simple and linear problems, while a multi-layer perceptron is more suitable for complex and non-linear problems