1. What is the function of a summation junction of a neuron? What is threshold activation function?

**Ans:** **A summation junction for the input signals is weighted by the respective synaptic weight. Because it is a linear combiner or adder of the weighted input signals, A threshold activation function (or simply the activation function, also known as squashing function) results in an output signal only when an input signal exceeding a specific threshold value comes as an input. It is similar in behaviour to the biological neuron which transmits the signal only when the total input signal meets the firing threshold.**

1. What is a step function? What is the difference of step function with threshold function?

**Ans: Binary step function is a threshold-based activation function which means after a certain threshold neuron is activated and below the said threshold neuron is deactivated.**

1. Explain the McCulloch–Pitts model of neuron.

**Ans: The McCulloch-Pitts model was an extremely simple artificial neuron. The inputs could be either a zero or a one. And the output was a zero or a one. And each input could be either excitatory or inhibitory.**

1. Explain the ADALINE network model.

**Ans: ADALINE (Adaptive Linear Neuron or later Adaptive Linear Element) is an early single-layer artificial neural network and the name of the physical device that implemented this network**

1. What is the constraint of a simple perceptron? Why it may fail with a real-world data set?

**Ans: The perceptron is the building block of artificial neural networks, it is a simplified model of the biological neurons in our brain. A perceptron is the simplest neural network, one that is comprised of just one neuron. Perceptron networks have several limitations. First, the output values of a perceptron can take on only one of two values (0 or 1) due to the hard-limit transfer function. Second, perceptrons can only classify linearly separable sets of vectors.**

1. What is linearly inseparable problem? What is the role of the hidden layer?

**Ans: Clearly not all decision problems are linearly separable: they cannot be solved using a linear decision boundary. Problems like these are termed linearly inseparable.Hidden layers allow for the function of a neural network to be broken down into specific transformations of the data. Each hidden layer function is specialized to produce a defined output.**

1. Explain XOR problem in case of a simple perceptron.

**Ans: XOR is where if one is 1 and other is 0 but not both. A "single-layer" perceptron can't implement XOR. The reason is because the classes in XOR are not linearly separable. You cannot draw a straight line to separate the points (0,0),(1,1) from the points (0,1),(1,0).**

1. Design a multi-layer perceptron to implement A XOR B.

**Ans: def XOR(A, B):**

**X = [A, B]**

**p\_or = Perceptron(train\_data, target\_or)**

**p\_nand = Perceptron(train\_data, target\_nand)**

**p\_and = Perceptron(train\_data, target\_and)**

**p\_or.train()**

**p\_nand.train()**

**p\_and.train()**

**return p\_and.classify([p\_or.classify(x), p\_nand.classify(x)])**

1. Explain the single-layer feed forward architecture of ANN.

**Ans: In this type of network, we have only two layers input layer and output layer but the input layer does not count because no computation is performed in this layer. The output layer is formed when different weights are applied on input nodes and the cumulative effect per node is taken. After this, the neurons collectively give the output layer to compute the output signals.**

1. Explain the competitive network architecture of ANN.

**Ans: Competitive learning is a form of unsupervised learning in artificial neural networks, in which nodes compete for the right to respond to a subset of the input data. A variant of Hebbian learning, competitive learning works by increasing the specialization of each node in the network.**

1. Consider a multi-layer feed forward neural network. Enumerate and explain steps in the backpropagation algorithm used to train the network.

**Ans: the back propagationalgorithm is used to compute the necessary corrections. The algorithm can be decomposed in the following four steps:**

* **Feed-forward computation**
* **Backpropagation to the output layer**
* **Backpropagation to the hidden layer**
* **Weight updates**

**The algorithm is stopped when the value of the error function has become sufficiently small.**

1. What are the advantages and disadvantages of neural networks?

**Ans: The network problem does not immediately corrode.Ability to train machine: Artificial neural networks learn events and make decisions by commenting on similar events. Parallel processing ability:  Artificial neural networks have numerical strength that can perform more than one job at the same time.**

1. Write short notes on any two of the following:
   * 1. Biological neuron: **Biological neurons, consisting of a cell body, axons, dendrites and synapses, are able to process and transmit neural activation.**
     2. ReLU function: **The rectified linear activation function or ReLU for short is a piecewise linear function that will output the input directly if it is positive, otherwise, it will output zero. It has become the default activation function for many types of neural networks because a model that uses it is easier to train and often achieves better performance.**
     3. Single-layer feed forward ANN
     4. Gradient descent
     5. Recurrent networks