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

function?

Ans-summation junction aggregates all the weighted inputs and then passes the result to the activation function. The activation function is a threshold function that gives out 1 as the output if the sum of the weighted inputs is equal to or above the threshold value and 0 otherwise.

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

Ans- Step Function is one of the simplest kind of activation functions. In this, we consider a threshold value and if the value of net input say y is greater than the threshold then the neuron is activated. Given below is the graphical representation of step function.

3. Explain the McCulloch–Pitts model of neuron.

The motivation behind the McCulloh Pitt's Model is a biological neuron. A biological neuron takes an input signal from the dendrites and after processing it passes onto other connected neurons as the output if the signal is received positively, through axons and synapses

4. Explain the ADALINE network model.

Ans- A network with a single linear unit is called Adaline (Adaptive Linear Neural). A unit with a linear activation function is called a linear unit. In Adaline, there is only one output unit and output values are bipolar (+1,-1). Weights between the input unit and output unit are adjustable.

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

Ans- The output of a perceptron can only be a binary number (0 or 1) due to the hard limit transfer function. Perceptron can only be used to classify the linearly separable sets of input vectors. If input vectors are non-linear, it is not easy to classify them properly.

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

Ans-  hidden layers are the reason why neural networks are able to capture very complex relationships and achieve exciting performance in many tasks

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

Ans- The XOr problem is that we need to build a Neural Network (a perceptron in our case) to produce the truth table related to the XOr logical operator. This is a binary classification problem. Hence, supervised learning is a better way to solve it. In this case, we will be using perceptrons.

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

Ans- The simplest kind of feedforward neural network is a linear network, which consists of a single layer of output nodes; the inputs are fed directly to the outputs via a series of weights. The sum of the products of the weights and the inputs is calculated in each node.

10. Explain the competitive network architecture of ANN.

Ans- A neural network consists of three layers. The first layer is the input layer. It contains the input neurons that send information to the hidden layer. The hidden layer performs the computations on input data and transfers the output to the output layer

11. Consider a multi-layer feed forward neural network. Enumerate and explain steps in the

backpropagation algorithm used to train the network.

Ans- Backpropagation is a special case of an older and more general technique called automatic differentiation. In the context of learning, backpropagation is commonly used by the gradient descent optimization algorithm to adjust the weight of neurons by calculating the gradient of the loss function.

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

## Ans.Pros OR Advantages of neural networks:

1. Neural networks have the ability to learn on their own and generate output that is not limited to the input they provide.
2. The input data is stored in its own networks instead of the database. Hence, data loss does not affect the way it operates.
3. The neural network will learn from instances and adapt them when a similar event occurs, thereby allowing them to function through an event in real-time.
4. Even if the neuron does not respond or information is lost, the network is still able to detect the fault and generate the output.
5. Neural networks conduct multiple tasks in parallel without impacting the performance of the system.
6. Storing information on the entire network.
7. Ability to work with incomplete knowledge.
8. Having fault tolerance.
9. Having a distributed memory.
10. Gradual corruption.
11. Ability to make machine learning.
12. Parallel processing capability.

**Cons OR Disadvantages of neural network:**

1. The main disadvantages of neural networks are their black-box nature.
2. Sometimes you need more control over the details of the algorithm, although there are libraries like Keras that make the development of neural networks fairly simple.
3. Neural networks usually require much more data than traditional algorithms, as in at least thousands if not millions of labelled samples.
4. Neural networks are also more complex in computing terms than traditional algorithms.
5. The duration of the neural network is unknown.
6. Hardware dependence.
7. Unexplained behaviour of the network.
8. Determination of proper network structure.
9. The difficulty of showing the problem of the network.

13. Write short notes on any two of the following:

1. Biological neuron- In the biological systems, a neuron is a cell just like any other cell of the body, which has a DNA code and is generated in the same way as the other cells. Though it might have different DNA, the function is similar in all the organisms.

2. ReLU function- A rectified linear unit (ReLU) is an activation function that introduces the property of non-linearity to a deep learning model and solves the vanishing gradients issue. "It interprets the positive part of its argument. It is one of the most popular activation functions in deep learning

3. Single-layer feed forward ANN- In its most basic form, a Feed-Forward Neural Network is a single layer perceptron. A sequence of inputs enter the layer and are multiplied by the weights in this model. The weighted input values are then summed together to form a total.

4. Gradient descent- Gradient descent is an optimization algorithm which is commonly-used to train machine learning models and neural networks. Training data helps these models learn over time, and the cost function within gradient descent specifically acts as a barometer, gauging its accuracy with each iteration of parameter updates

5. Recurrent networks- A recurrent neural network (RNN) is a type of artificial neural network which uses sequential data or time series data.