1. Explain the architecture of Spark

Spark follows master-slave architecture. It consists of RDD(Resilient Distributed Dataset) and DAG(Direct Acyclic Graph).
In RDD data is in memory and is shared among different nodes, fault-tolerant and follows lazy evaluation.
DAG consists of a driver program, cluster manager and worker node. First driver runs the main function and creates the Spark context object. Spark context purpose is to coordinate the spark application to run as a different set of processes in a cluster. The purpose of cluster manager is to allocate resources across worker nodes. Worker node is the slave node whose purpose is to run the application in a cluster.

2. Explain activation function

Activation function is a type of function in a neural network which introduces non linearity into the output of the neuron. This helps in learning complex patterns from the dataset and increases the accuracy of the model. The common activation functions in neural networks are sigmoid function, tanh function(Hyperbolic tangent function), ReLU(Rectified Linear Unit), Leaky ReLU, ELU(exponential Linear Unit).

3. List different types of activation function with their formula

Sigmoid function:

Formula : sigmoid(x) = $1/(1+e^{-x})$
Range = (0, 1)
Characteristics:

- The curve in the graph is S shaped.
- The curve is smooth and continuous.

Tanh function(Hyperbolic tangent function):

Formula : tanh(x) = $(e^{x}-e^{-x})/(e^{x}+e^{-x})$
Range = (-1, 1)
Characteristics:

- The curve in the graph is S shaped and centered at 0.
- The curve is symmetric around the origin.

ReLU(Rectified Linear Unit):

Formula : ReLU(x) = max(0, x)
Range = (0, +inf)
Characteristics:

- The simplest activation of all.
- As the formula is easy, its computation is fast compared to others.

Leaky ReLU:
This is category of ReLU
Formula : LReLU(x) = x if x>0, ax otherwise
Range = (-inf, +inf)
Characteristics:

- This came into effect to overcome dying neuron problems, vanishing gradient problems and it does overcome them effectively.
- It allows small values.

ELU(Exponential Leaky Unit):
This is category of ReLU
Formula : ELU(x) = x if x>0, a(e^x-1) otherwise
Range = (-a, +inf)
Characteristics:

- This function operates with small values and also at 0.
- This also overcomes dying neuron problems and vanishing gradient problems like leaky ReLU.

5. Explain Neural Networks

Neural networks are computational models inspired by the structure of neurons and neural networks in the human brain.
Neural network main components are nodes(neurons), layers, weights and biases, activation function, forward propagation, backward propagation and loss function.
Nodes are the fundamental block of a neural network. Each neuron is associated with weight and bias.
Layers are the structure in which neural networks look in order to train the inputs and predict the output. Neural network consists of three layers such as input layer, hidden layer and output layer. Input layer is where the input data is fed into the network. Hidden layer is between the input and output layer. There may be one or more hidden layers. In the hidden layer the mathematical operations are performed with weights, biases and activation function. The output layer where we predict the output and get the result.
Loss function is the difference between the actual and predicted output.
Weights and biases are present with each neuron. These are adjusted to minimize the loss function. This helps in increasing the accuracy of the mode.
Activation function adds the non-linearity into the output of the neuron and helps in learning complex pattern in the data and helps in increasing the model accuracy. The various activation function are sigmoid, tanh, ReLU, leaky ReLU and ELU.
Forward propagation phase input data is passed from the input layer to the output layer and mathematical operations are applied at each layer till we get the output.
Backward propagation phase the weight and bias are updated based on the loss function.