By adding ② and ⑤, we get

$$w_1 + w_2 \geq -w_0$$

But the ④ Equation defines, $w_1 + w_2 < -w_0$

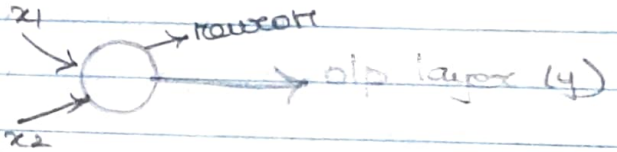
So, it is a non-linear data. Hence, we cannot perform perceptron.

Note: In order to solve non-linear data, we go for Multi-Layer Perceptron (MLP)

Linear network/machine
* Separate with a line
* degree of function is ≤ 1
* Slope is constant

Non-linear network/machine
separate with curves
degree of function is > 1
slope will varies

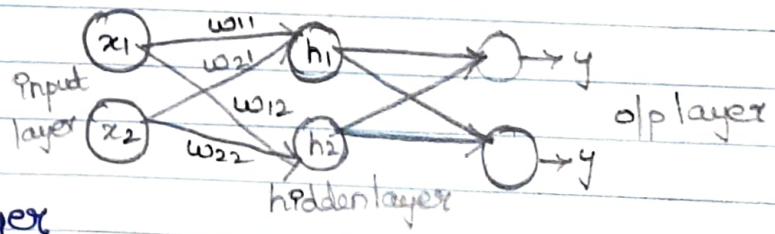
Single layer neural network:



Single output layer (only one output)

Multi-layer neural network:

→ fully connected layer
→ layer between input and output layer called hidden layer



→ all the outputs are interconnected to hidden layer
(All the neurons are interconnected)

we can have n-number of hidden layers

Input layer
Based on the features of input datasets, comes
Based on the class, the output layers comes

MLP (Multilayer Perceptron) has weight for each and every edges.

Multilayer perceptron:

Multilayered perceptron have layer of nodes.

Data flow from first layer to second layer, from second layer to next consecutive layered nodes.

(2 marks)

This type of network with information flowing from one end to another in one direction through intermediate layer is called feed forward network.

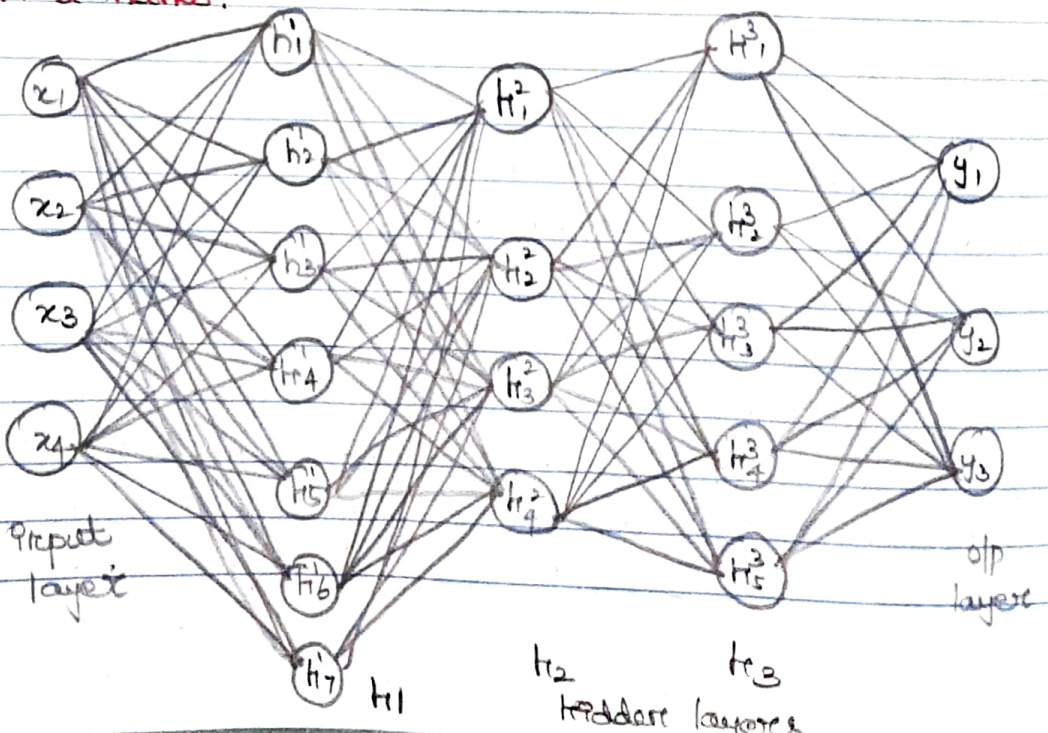
Features of MLP:

A network with multiple hidden layers is a multi layered perceptron.

The nodes in the hidden layer and output layer are processing unit with non-linear activation functions.

The multiple hidden layers combined with non-linear activation function helps it to solve non-linear seperable problems.

Problem: 2 marks:



→ 3 hidden layers
→ 1 output layer
→ So, 4 layered network

Hidden layer 1 – 7 nodes
2 – 4 nodes
3 – 5 nodes
output layer 1 – 3 nodes

Calculation of total number of parameters:

Associated layer	No. of weights (Interconnecting layer nodes multiplication)	Bias (no. of nodes)
Input layer to h_1	$4 \times 7 = 28$	7
h_1 to h_2	$7 \times 4 = 28$	4
h_2 to h_3	$4 \times 5 = 20$	5
h_3 to output layer	$5 \times 3 = 15$	3
Total	91	19

Total no. of parameter = No. of weight (total) + bias (total)
$= 91 + 19 = 110$

The complexity of neural network depends on the number of hidden nodes

It is essential to find the right number of hidden nodes by fine tuning the model with various combinations.

The problem at hand is how to change

For single layer perceptron, weights and bias between the hidden and o/p layer were updated using the difference between the actual and predicted outputs of the o/p layer.

For multilayer perceptron, there is no basis to know the expected output of the hidden layer. So, learning algorithm used in MLP is backpropagation algorithm.

Optimization Technique:

The difference between the actual and the predicted o/p shows the amount of error in the model.

As this error is minimized, the model becomes better.

Error function (or) loss function:

Loss function $L(w,b)$