

2 Attempt any **two** parts :

(a) Discuss the functioning of a perceptron. Consider **10** the classification problem defined below

$$\{p_1 = [-1, 1], t_1 = 1\} \quad \{p_2 = [0, 0], t_2 = 1\}$$

$$\{p_3 = [1, -1], t_3 = 1\} \quad \{p_4 = [1, 0], t_4 = 0\}$$

$$\{p_5 = [0, 1], t_5 = 0\}$$

$p_i \rightarrow i\text{-th input}$

$t_i \rightarrow i\text{-th target}$

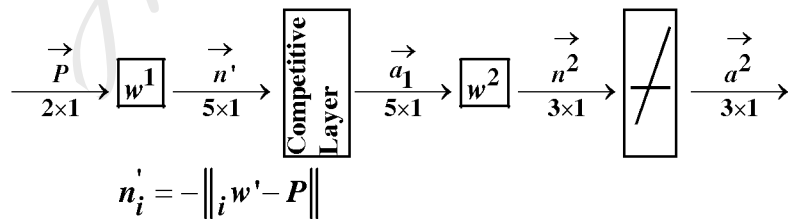
Design a single neuron perceptron to solve this problem. You need to describe architecture of perceptron, its decision boundary.

(b) Discuss back propagation algorithm for a **10** multilayer network.

(c) Discuss the functioning of recurrent networks. **6+4** What are strengths and limitations of such network.

3 Attempt any **two** parts :

(a) Consider LVQ network shown below



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a' = competitive net (n')

$$a'_i = \begin{cases} 1 & i = \text{neuron with largest net input} \\ 0 & \text{otherwise} \end{cases}$$

$$a^2 = w^2 a'$$

$$w^1 = \begin{bmatrix} 0 & 0 \\ 1 & -1 \\ 1 & 1 \\ -1 & 1 \\ -1 & -1 \end{bmatrix} \quad w^2 = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 \end{bmatrix}$$

Determine regions of each class and draw a graph to illustrate this.

- (b) Write short notes on **4+6**
- (1) Vector quantization
 - (2) Unsupervised learning and its relative merits and limitations with respect to supervised learning.
- (c) Discuss Hebb rule in context of : **4+6**
- (1) Supervised learning
 - (2) Unsupervised learning.

4 Attempt any two parts :

- (a) What do you understand by associative networks ?
In this context explain working of a Hopfield network.

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- (b) Describe brain-in-a-box model. Compare it with a recurrent network.
- (c) Derive expression for Boltzmann learning rule. **10**

5 Attempt any **two** parts :

- (a) Define gradient. Using steepest descent rule to **10** the following function

$$f(x) = x_1^2 + 5x_1x_2 + 10x_2^2$$

determine first three points of trajectory starting from

$$x_0 = [0.5, 0.5]$$

- (b) Discuss the role of **2+4+4**
 - (1) Selection
 - (2) Cross-over
 - (3) Mutationin context of genetic algorithm.
- (c) Write an algorithm to implement simulated **10** annealing.
