Q1) ***[10 Marks]***

A- define the following

- Supervised Learning
- Hetero-Associative Nets.
- Competitive Nets.

B- What is the difference between binary and bipolar representations of data? Which is better? Why?

Q2) ***[10 Marks]***

Consider a **Hopfield** net with 4 neurons.

A- Find the weight matrix to store the vectors

(1 0 0 0) , (1 1 0 0) , (0 0 0 1) , and (0 0 1 1) in it.

B- Test the network using the vector (0 1 1 1).

C- Modify the weights to store the vector (1 1 1 0).

D- Draw the architecture of this net.

Q3) ***[10 Marks]***

A. Use the outer product version of Hebb rule learning to find the weight matrix in bipolar form for the **BAM** based on the following binary input-output vector pairs:

S	T
1 0 0 0	1 1
1 0 0 1	1 0
0 1 0 0	1 0
0 1 1 0	0 1

B. Draw the architecture of the network.

C. Using the unit step function (with threshold 0) as the output unit's function, test the response of the network on the following two vectors:

- X=(1 1 1 1)
- Y=(0 1).

Q4) ***[10 Marks]***

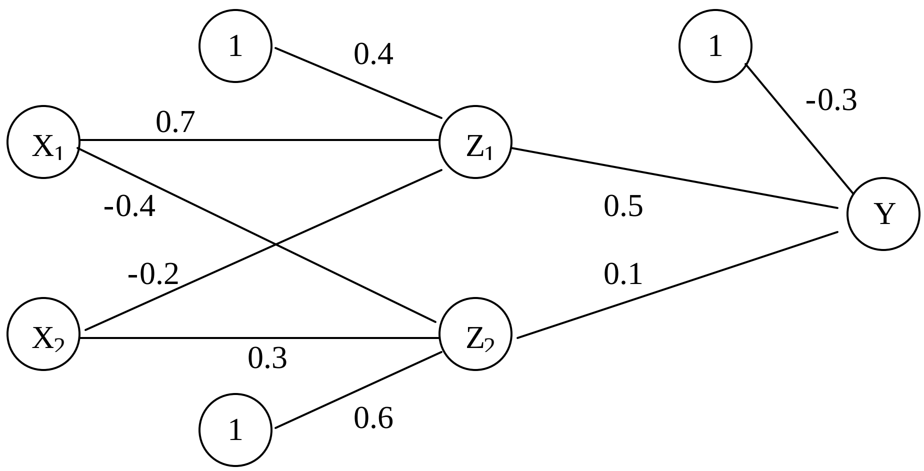
Consider a **Maxnet** with four units. Find the winner unit when the initial activations (input signals) as follows:

$A_1(0) = 0.7$ $A_2(0) = 0.2$ $A_3(0) = 0.5$ $A_4(0) = 0.3.$

Assume that e = 0.2.

Q5) ***[10 Marks]***

Given the following three layer **BPN** with the binary sigmoid activation function assuming that the training rate of α=0.25



A- Find the output of the network if the pattern (0 1) is applied to its inputs.

B- Calculate the *weight correction term* of the output unit.

Find useful values in the following table

X	0.05	0.1	0.2	0.4	0.55	0.7	0.9	1.0
F(X)	0.51	0.52	0.55	0.6	0.63	0.67	0.71	0.73
F’(X)	0.25	0.249	0.248	0.24	0.233	0.221	0.2	0.197

Good Luck