Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

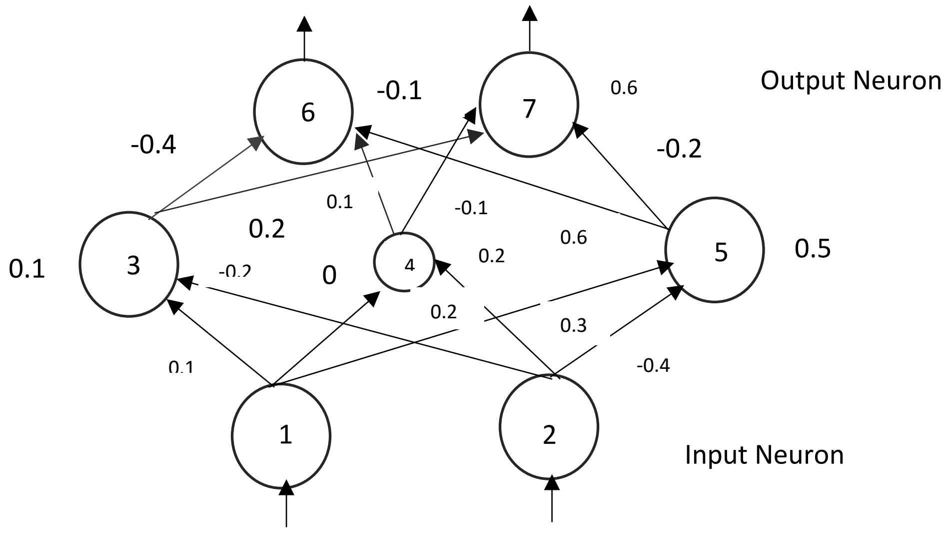
Course: Artificial Intelligence and Neural Network **Semester: V**
Program: M. Tech. / ARE **Time 03 hrs.**
Course Code: CSAI 7001 **Max. Marks: 100**
Instructions: Attempt all the questions

SECTION A

S. No.		Marks	CO
Q 1	**Answer the following questions:** (a) What is Artificial intelligence? (i) Putting your intelligence into Computer (ii) Programming with your own intelligence (iii) Making a Machine intelligent (iv) Playing a Game (b) Heuristic function h(n) is, (i) Lowest path cost (ii) Cheapest path from root to goal node (iii) Estimated cost of cheapest path from root to goal node (iv) Average path cost (c) ___________________ are mathematical problems defined as a set of objects whose state must satisfy a number of constraints or limitations. (i) Constraints Satisfaction Problems (ii) Uninformed Search Problems (iii) Local Search Problems (iv) All of the above (d) What is meant by simulated annealing in artificial intelligence? (i) Returns an optimal solution when there is a proper cooling schedule (ii) Returns an optimal solution when there is no proper cooling schedule (iii) It will not return an optimal solution when there is a proper cooling schedule (iv) None of the mentioned	**4**	**CO1**
Q 2	Elucidate the architecture and operation of Adaptive Resonance Theory.	**4**	**CO3**
Q 3	Differentiate multi-layer neural network and radial basis function neural network.	**4**	**CO2**
Q 4	Differentiate depth first search and breadth first search algorithm with a suitable example.	**4**	**CO1**
Q 5	Elucidate the convergence criteria in optimization techniques. How the algorithms are examined based on the convergence criteria.	**4**	**CO4**

SECTION B

Q 6	How particle swarm optimization is different from evolutionary computation technique? Illustrate the pseudo code and mathematical model of particle swarm optimization algorithm. Briefly explain the convergence phenomenon of optimization algorithm.	**10**	**CO4**
Q 7	Differentiate between A* algorithm and AO* algorithm. Solve the crypt arithmetic problem using constraint satisfaction search procedure, FOUR + FOUR = EIGHT	**10**	**CO1**
Q 8	A neural network is shown in figure 1 with initialized weights, explain the network architecture knowing that we are trying to distinguish between nails and screws and an example of training tupples is as follows: T1{0.6, 0.1, nail}, T2{0.2, 0.3, screw}.	**10**	**CO2**

	Let the learning rate be 0.1 and the weights are as indicated in figure. Do the forward propagation of the signals in the network using T1 as input, then perform the back propagation of the error. Find out the weight change.  Figure 1		
Q 9	Explain the following terms: (a) Linear and Quadratic Classifier (b) Decision Trees **OR** Explain the following terms: (a) Inductive Logic Programming (b) k-Means Clustering	**10**	**CO3**
	SECTION-C		
Q 10	(a) An HMM with 2 states has been constructed to generate a sequence of symbols. Each time the Markov chain visits a state, one symbol (A, B, C, D) is generated. In state 1, symbol A is generated with probability 0.1 and symbol B, C, D each with probability 0.3. In state 2, A is generated with probability 0.7 and each of the other symbols with probability 0.1. The Markov chain jumps from state 1 to state 2 with probability 0.4 and from state 2 to state 1 with probability 0.2. Consider a sequence x= CDAAA generated by this HMM. The forward probabilities for the first four symbols in x, CDAA, have been calculated: $f_1(1) = 0.27$, $f_1(2) = 0.0492$, $f_1(3) = 0.0032$, $f_1(4) = 0.0006$ $f_2(1) = 0.01$, $f_2(2) = 0.0116$, $f_2(3) = 0.0203$, $f_2(4) = 0.0122$ Use these to calculate P(x = CDAAA).	**20**	**CO3** **CO2**
Q 11	Tic-tac-toe is a game for two players. The board is a square of 3 X 3 fields. Each player is assigned a type of token (O or X). Initially the board is empty. The players play in turn and place a token on an empty field. A player wins if she/ he has first aligned three of her/his tokens either in a row, a column or one of the two diagonals. The game ends when a player wins or when there are no more empty fields. (i) Design the search tree for tic-tac-toe up to level 3. Take into account symmetric game states, i.e. those states that can be transformed into each other by rotation and mirroring.	**20**	**CO1**

(ii) Give an estimation on the number of possible different tic-tac-toe games.
(iii) Develop an evaluation function for the tic-tac-toe game.
(iv) Indicate the value of your evaluation function for each node of the search tree at level 3. Use these values to compute the values of the nodes on level 2, 1 and 0 using the MINMAX algorithm.
(v) Indicate all the nodes in the search tree that would not have been considered when using ***alpha-beta*** pruning.

OR

(a) Consider the tree shown in figure 2. The numbers on the arcs are the arc length; the heuristic estimates of B = 4, C = 3 and D = 2; all other states have a heuristic estimate of 0.

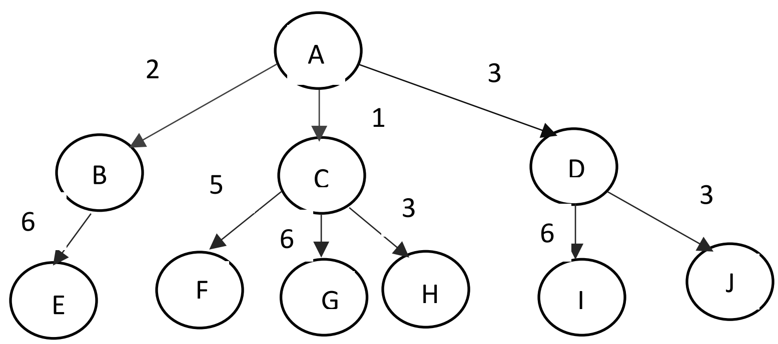


Figure 2

Assume that the children of a node are explained in alphabetical order when no other order is specified by the search and that the goal is state J. No visited or expanded lists are used. In what order would the states be expanded by each type of search (DFS, BFS, best-first search and A*). Write only the sequence of states expanded by each search.

(b) The 8-puzzle is a 3 X 3 square tray in which 8 square tiles are placed as shown in figure 3. See the remaining ninth square is free. Each tile is numbered. A tile that is adjacent to the blank space can be moved into that space. There is a starting and a goal position in the game. The goal is to transform the starting position into the goal position by moving the tiles around.

1	2	3
6	-	4
8	7	5

Start State

1	2	3
4	5	6
7	8	-

Goal State

Figure 3