Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous College Affiliated to University of Mumbai)

End Semester Examination

December 2022

Max. Marks: 100 | **Duration: 3 Hrs.**

Class: TE COMPS/IT | **Semester:V**

Course Code: CE303B/IT303B | **Branch: COMP/IT.**

Name of the Course: Artificial Intelligence and Machine Learning

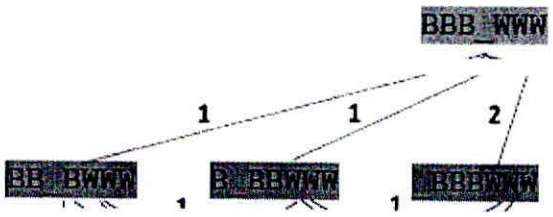
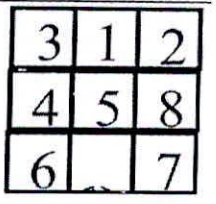
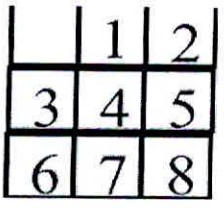
Instruction:

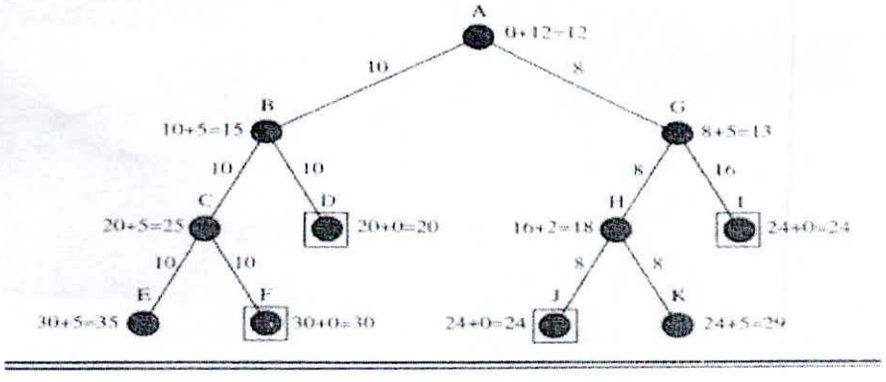
(1) All questions are compulsory.

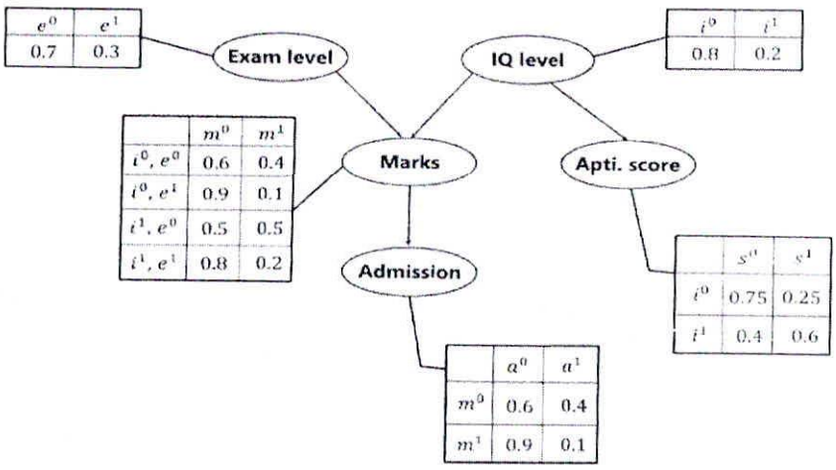
(2) Draw neat diagrams.

(3) Assume suitable data if necessary.

Q. No.	Questions	Max Marks	CO-BL-PI
Q1a	Define Artificial Intelligence laid out along two dimensions covering all four categories or approaches of AI. Also, Explain each approach of AI definitions briefly.	10	1-3-4.3.1
Q1 b	The sliding-tile puzzle consists of three black tiles, three white tiles, and an empty space in the configuration shown below: B B B _ W W W The puzzle has two legal moves with associated costs: 1) A tile may move into an adjacent empty location. This has a cost of 1. 2) A tile may hop over one or two other tiles into the empty position. This has a cost equal to the number of tiles jumped over. The goal is to move all the white tiles to the left of all the black tiles. The position of the blank is not essential.		2-3-4.3.1

	 The above example shows legal moves cost, a) Draw the first three levels of the state space of the sliding-tile puzzle. Label each arc with the cost of the move. b) Apply the Best first search algorithm f(n)=h(n) to the above SST of three levels for the search to reach the goal. Draw the resultant SST with only those nodes that are generated. If a node is generated but not opened, connect it with a dotted line. If a node is opened, connect it with a solid line. Use the double solid line to show your partial solution path. Consider the cost of the move/arc given above as a heuristic.	**04** **06**	
Q2 a	1-Solve 8 puzzle problems using the steepest ascent hill climbing. Use the misplaced tiles heuristic. 2- State the drawbacks of the hill Climbing algorithm start  goal 	**6** **4**	**2-3-4.3.1**
Q2b	Give a representation in First order predicate logic of the following propositions, in the form of Horn clauses; also in this case, first of all clearly define the domain of discourse and the predicate, function, and constant symbols you intend to use. (a) Cows, pigs and horses are mammals (b) The child of a horse is a horse (c) Bluebeard is a horse (d) Bluebeard is Charlie's father (e) Child and father are inverse relations (f) Every mammal has a father Prove that the proposition "Charlie is a mammal" is entailed by the above propositions, using the backward chaining inference algorithm.	**10**	**3-3-4.3.1**

Q3a	Consider the given State Space tree where every node is showing f-cost, g-cost, and h-cost. Nodes in the square box are Goal nodes. Our aim is to reach the optimal Goal. Apply the SMA* algorithm with the memory bound of 3 nodes. Show the updated iteration at every stage with the rule applied to update the f-costs.  **OR** Apply Uninformed Search algorithms on a Binary tree(branching factor=2) where nodes are in the sequence of A to Z, where M is the only Goal. Draw the portion of the state space for states A to Z. Stop whenever you reach goal state 'M'. List the order in which nodes will be visited for: 1- BFS 2- DFS 3-Iteratative Deepening Compare these algorithms with respect to evaluation criteria to measure the performance of search algorithms	**10**	**2-3-4.3.1**
Q3b	i- Define Version Space. ii- Apply the Candidate elimination algorithm to get Version space for the given dataset. 		c(d)	hair	body	likesSimon	pose	smile	smart
---	---	---	---	---	---	---	---
1	1	blond	thin	yes	arrogant	toothy	no
2	0	brown	thin	no	natural	pleasant	yes
3	1	blond	plump	yes	goofy	pleasant	no
4	0	black	thin	no	arrogant	none	no
5	0	blond	plump	no	natural	toothy	yes | **OR** i- Define the terms True error and Sample Error. ii- Write a short note on Bais variance Trade-off	**03** **07** **03** **07**	**4-3-4.3.1**

Q4a	Imagine that we are given the task of modeling a student's marks (m) for an exam he has just given. The given Bayesian Network Graph below and CPT Tables are shown in the graph, calculate the Joint probability Distribution for given two cases: 1- in spite of the exam level being difficult, the student having a low IQ level and a low Aptitude Score manages to pass the exam and secure admission to the university. 2- The student has a High IQ level and Aptitude Score, the exam being easy yet failing to pass and does not secure admission to the university.  e^0 e^1 0.7 0.3 i^0 i^1 0.8 0.2 m^0 m^1 i^0, e^0 0.6 0.4 i^0, e^1 0.9 0.1 i^1, e^0 0.5 0.5 i^1, e^1 0.8 0.2 s^0 s^1 i^0 0.75 0.25 i^1 0.4 0.6 a^0 a^1 m^0 0.6 0.4 m^1 0.9 0.1	**10**	**4-3-4.3.1**
Q4 b-i	Consider **EnjoySport** learning task. Given that the attribute **Sky** has three possible values, and that **AirTemp, Humidity, Wind, Water,** and **Forecast** each have two possible values Consider the above learning task and Define the following 1- Instance Space, 2-Hypothesis space, 3-Version Space	**04**	
b-ii	Given Confusion metrics for cancer prediction example, for 100 patients. Calculate 1-Precision, 2- Recall, 3- F1-score, and also write the interpretation of each metric Actual (True) Values: Cancer / No Cancer Predicted Values: Cancer — 45 / 18 Predicted Values: No Cancer — 12 / 25	**06**	