06/01/2023 - FN.

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 70016

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Artificial Intelligence and Data Science

AL3391 – ARTIFICIAL INTELLIGENCE

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

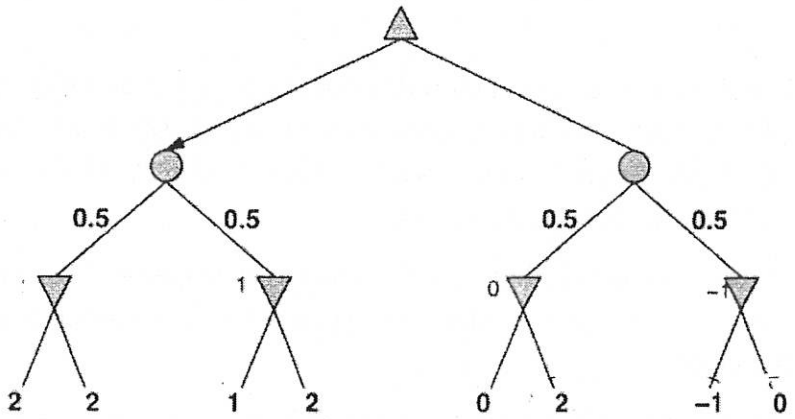
1. Characterize the environment of an agent playing soccer.

2. Can an agent that senses only partial information about the state always be perfectly rational?

3. Define admissible and dominant heuristics.

4. What is the purpose of a contingency plan?

5. In the game tree given below, Δ represents Max node, ∇ represents min node and $\circ$ represents chance nodes. Find the utility value of the root node.



6. Give a precise formulation of the following constraint satisfaction problem in terms of variables, domain and constraints: There are a five professors and 10 classrooms, a list of classes to be offered, and a list of possible time slots for classes Each professor has a set of classes that he or she can teach.

7. State the converse and contrapositive of the statement "When I stay up late, it is necessary that I sleep until noon".

8. Define the terms belief state and state estimation.

9. How are Bayesian networks represented?

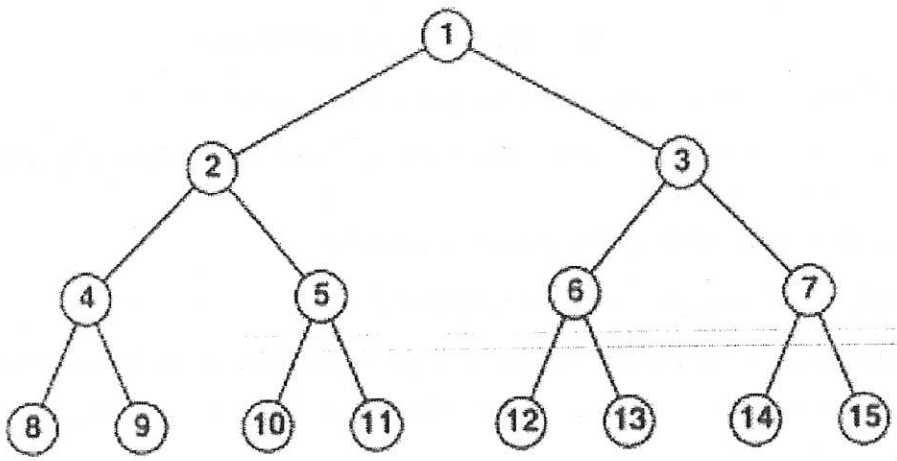
10. What is the purpose of relational probability models?

PART B — (5 × 13 = 65 marks)

11. (a) Define an agent. Explain the four basic agents that embody the principles underlying intelligent systems with examples.

Or

(b) Consider a state space given below.

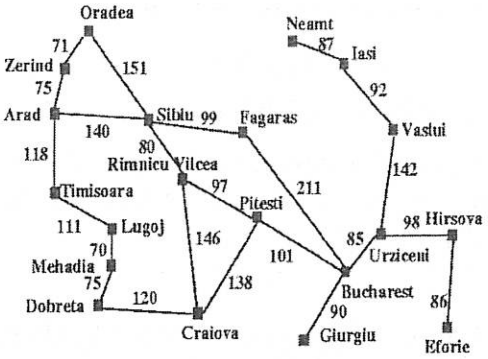


(i) If the goal state is numbered '11', list the order in which the states will be visited using (1) breadth first search (2) depth first search (3) depth limited search with a limit 2 (depth of the root is 0) (4) iterative deepening search.

(ii) If iterative deepening search is used to traverse the state space, how many times will the state space tree be constructed to reach the goal?

(iii) If bidirectional search is used to reach the goal state, what would be the branching factor in the forward and backward direction?

12. (a) Outline A* Algorithm. Trace the algorithm to find the shortest route from Lugoj to Bucharest using the straight line distance heuristic. Show the sequence of nodes traversed by the algorithm. The straight line distances are given below.

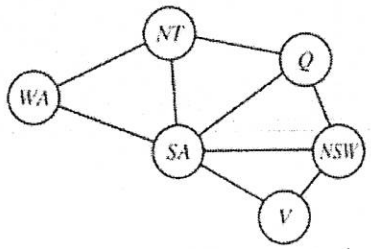


Town	Air Dist.	Town	Air Dist.
Arad	366	Mehadia	241
Bucharest	0	Neamt	234
Craiova	160	Oradea	380
Dobreta	242	Pitesti	100
Eforie	161	Rimnicu Vilcea	193
Fagaras	176	Sibiu	253
Giurgiu	77	Timisoara	329
Hirsova	151	Urziceni	80
lasi	226	Vaslui	199
Lugoj	244	Zerind	374

Or

(b) How does online agents search in unknown environments?

13. (a) Consider the map coloring problem with 6 variables and three colors (red, green and blue). The constraint graph for the problem is given below. How does backtracking search solve the given problem? What are the heuristics used to improve the efficiency of the search? How are failures detected early in backtracking? Can Breadth first search be applied to the above problem? State reasons for your answer.



Or

(b) What are partially observable games? How are they solved in a deterministic environment?

14. (a) Express the following statements as predicates:

- All people who are not poor and are smart are happy
- Those people who read are not stupid.
- John can read and is wealthy.
- Happy people have exciting lives.

Skolemnize the above statements if required and prove the following by resolution: "Can anyone be found with an exciting life?" (Assume ~ stupid ≡ smart, wealthy ≡ ~ poor)

Or

(b) During a murder investigation, you have gathered some clues. Express them as propositions and solve the following scenario using laws of inference. The clues gathered are given below:

- If the knife is in the store room, then we saw it when we cleared the store room.
- The murder was committed at the basement or inside the apartment.
- If the murder was committed at the basement, then the knife is in the yellow dust bin.
- We did not see a knife when we cleared the store room.
- If the murder was committed outside the building, then we are unable to find the knife;
- If the murder was committed inside the apartment, then the knife is in the store room.

Find:: "where is the knife?"

15. (a) (i) Consider there are 3 boolean variables toothache, catch and cavity. From the full joint distribution given below, calculate the following: (8)

	toothache		*¬toothache*	
	catch	*¬catch*	*catch*	*¬catch*
cavity	0.108	0.012	0.072	0.008
¬cavity	0.016	0.064	0.144	0.576

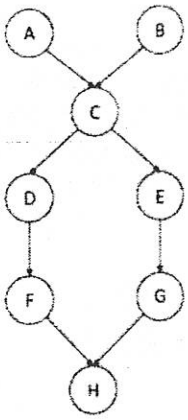
(1) P(toothache)

(2) P(Cavity)

(3) P(Toothache | cavity)

(4) P(Cavity | toothache v catch)

(ii) What is d-separation? When are two nodes d-separated? From the Bayesian network given below, find whether D and E d-separated given evidence about both A and B? State reasons for your answer. (5)

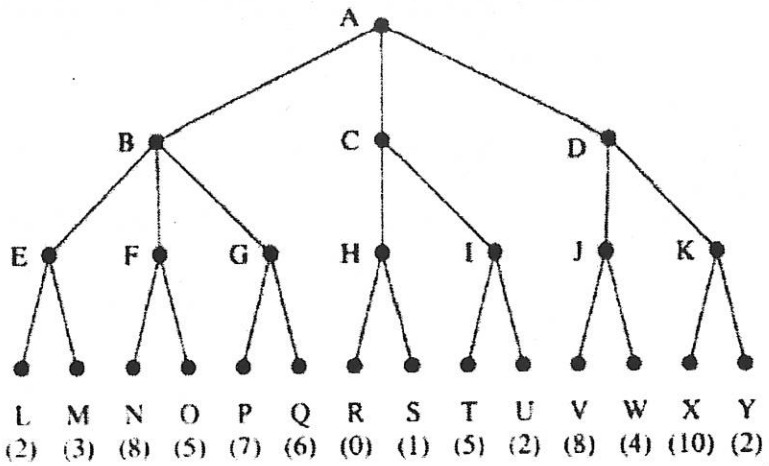


Or

(b) How does direct sampling methods help in approximate inference?

PART C — (1 × 15 = 15 marks)

16. (a) Consider the following game tree in which the static scores (in parentheses at the tip nodes) are all from the first players point of view. Assume that the first player is the maximizing player.



Which move should the first payer choose? Use minimax algorithm on the game tree and list the nodes which would not be examined using the alpha-beta algorithm assuming that nodes are examined in left-to-right order? Will the same branches be pruned if the nodes are examined In right-to-left order? Is alpha-beta algorithm guaranteed to force a win whenever possible? State reasons.

Or

(b) You have a new burglar alarm installed at home. It is fairly reliable at detecting a burglary, but also responds on occasion to minor earthquakes. You also have two neighbors, John and Mary, who have promised to call you at work when they hear the alarm. John nearly always calls when he hears the alarm, but sometimes confuses the telephone ringing with the alarm and calls then, too. Mary, on the other hand, likes rather loud music and often misses the alarm altogether. The Bayesian network and the conditional probability table (CPT) for the scenario is given below. In the CPTs, the letters B, E, A, J, and M stand for Burglary, Earthquake, Alarm, JohnCalls, and Marycalls, respectively. From the Bayesian network, find P(B /J,M) using variable elimination.