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Dr. B R Ambedkar National Institute of Technology, Jalandhar
 B Tech (Computer Science & Engineering) 7th Sem.
CSPC-405, Artificial Intelligence
Major Examination, Dec. 2024

Duration: 03 Hours Max. Marks: 50 Date: 5th Dec. 2024

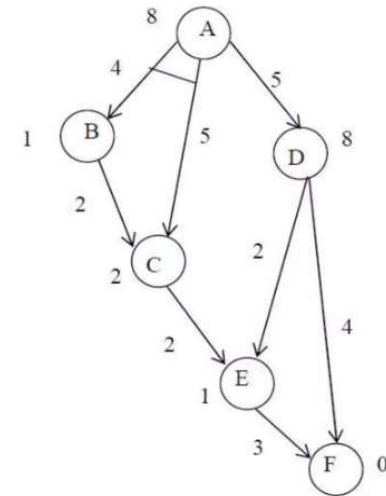
Question Number	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>
Marks	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>5*2</u>
CO No.	<u>1</u>	<u>4</u>	<u>2</u>	<u>2</u>	<u>3</u>	<u>3</u>	<u>1</u>	<u>4</u>	<u>3</u>
Learning Level	<u>L</u>	<u>L</u>	<u>H</u>	<u>M</u>	<u>H</u>	<u>M</u>	<u>H</u>	<u>M</u>	<u>H</u>

Note:

1. Attempt all the questions.
 2. Non-Programmable Calculators are allowed
1. Describe the architecture of an expert system and explain the role of its main components, such as the knowledge base, inference engine, and user interface. Provide a simple diagram illustrating how these components interact to solve problems.
 2. Explain the concept of competitive learning and contrast it with supervised learning methods. Discuss how competitive learning adapts to input data and highlight real-world scenarios where this approach is particularly useful.
 3. Evaluate the Turing Test as a measure of machine intelligence. Discuss how it assesses cognitive capabilities and analyze its limitations in the context of modern AI advancements.
 4. How does the structure of a decision tree influence its search within the hypothesis space in the context of concept learning? Compare the impact of different splitting criteria, on the

exploration of hypothesis space and how they affect the overall accuracy of the decision tree model.

5. Critically analyze the Problem Reduction (AO) approach in problem-solving. Discuss its strengths and limitations, and apply it to determine the optimal solution path for the given scenario



6. 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
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The puzzle has two legal moves with associate 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 important.

a) Draw the first three levels of the state space of the sliding-tile puzzle.

b) Propose a heuristic for solving this problem and analyze it with respect to admissibility and monotonicity.

c) Based on the partial state space you have drawn, find a partial solution path using the A* Algorithm.

7. Alex and Sarah are two neighbours who report suspicious activity in the neighbourhood. You want to assess whether their reports indicate a genuine fire incident. Based on historical data:

- i. The probability of a fire occurring in the neighbourhood is $P(F)=0.02$.
- ii. If a fire occurs, Alex reports a probability of $P(A|F)=0.85$, and Sarah reports it with a probability of $P(S|F)=0.9$.
- iii. If no fire occurs, Alex still reports suspicious activity (false alarm) with a probability of $P(A|\neg F)=0.15$, and Sarah reports it with a probability of $P(S|\neg F)=0.1$
- iv. Alex and Sarah's reports are conditionally independent given whether a fire occurs.

Draw the Bayesian Network and calculate the probability that a fire occurred if both Alex and Sarah report suspicious activity?

8. Describe the key components of Predicate Logic and convert the following sentences into predicate logic:

a) Some employees attended a Python programming course in the Fall of 2023.

b) There exists a gardener who waters all plants in the neighbourhood that are not watered by their owners.

9. Compare and contrast the following concepts, focusing on their main differences and similarities:

a) Monotonic Reasoning and Non-Monotonic Reasoning

b) Procedural Knowledge and Declarative Knowledge.