

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(MID SEMESTER EXAMINATION SP/2024)

CLASS: B.TECH  
BRANCH: CSE

SEMESTER : VI/ADD  
SESSION : SP/2025

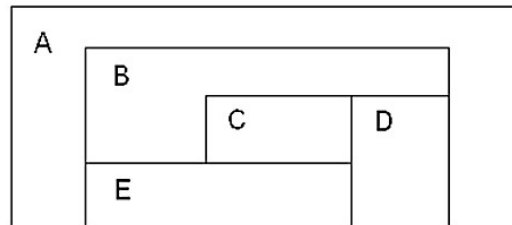
SUBJECT: CS335 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING  
TIME: 02 HOURS

FULL MARKS: 25

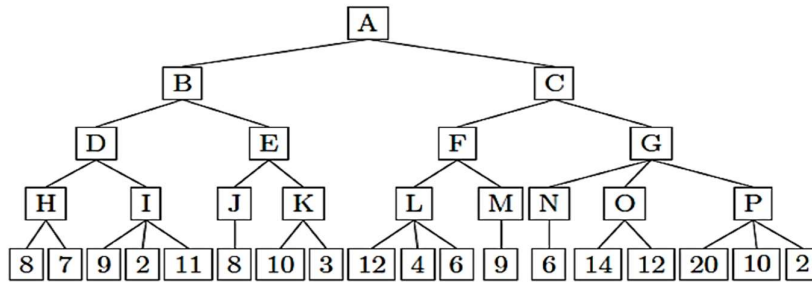
**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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|--------|---|-----------|----|-----|
| Q.1(a) | Differentiate between Depth First Search (DFS) and A* algorithm.  | [2]       | 1  | 4   |
| Q.1(b) | Which of the following statements are true and which are false? Explain your answers.<br>(i) $h(n) = 0$ is an admissible heuristic for the 8-puzzle.<br>(ii) Assume that a rook can move on a chessboard any number of squares in a straight line, vertically or horizontally, but cannot jump over other pieces. Manhattan distance is an admissible heuristic for the problem of moving the rook from square A to square B in the smallest number of moves. | [1.5+1.5] | 1  | 5   |
| Q.2(a) | Define Constraint Satisfaction Problem (CSP) with an example.   | [2]       | 1  | 1   |
| Q.2(b) | Consider the following map coloring problem where five regions A, B, C, D, and E, need to be colored using only three colors: Red, Green, and Blue. The constraint is that adjacent regions cannot have the same color. Demonstrate how the Minimum Remaining Value (MRV) and Least Constraining Value (LCV) improve backtracking algorithm in Constraint Satisfaction Problem.   | [3]       | 1  | 3,4 |



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|--------|---|-----|---|---|
| Q.3(a) | Explain how Simulated Annealing avoids getting stuck in local optima. What happens if the temperature decreases too quickly in Simulated Annealing?   | [2] | 1 | 3 |
| Q.3(b) | Solve the following optimization problem using Hill Climbing: Given a function $f(x)$ , where $x$ is an integer and $f(x) = -(x - 5)^2 + 25$ , apply the Hill-Climbing algorithm starting from $x = 0$ . Show the steps until a first peak is reached (Move to the neighbour with a higher function value (i.e., try $x+1$ ). Is the first peak a local optimum? Justify your answer. | [3] | 1 | 5 |
| Q.4(a) | How alpha-beta pruning helps to reduce search space in mini-max algorithm?  | [2] | 1 | 1 |
| Q.4(b) | Consider the tree like graph below. Assume the top level is a MAX node. Use mini-max algorithm with alpha-beta pruning to determine the associated utility of node A if it visits the left branches of node A only. Also show which of the left branches of node A will be pruned. Note that no need to explore right child of node A   | [3] | 1 | 3 |



- Q.5(a) What is knowledge representation in knowledge-based agent Artificial Intelligence system? Explain it with a suitable diagram and an example. [2] 2 1
- Q.5(b) Consider the following knowledge: [3] 2 3  
 Either Alice attended the meeting or Alice was not invited. If the boss wanted Alice at the meeting, then she was invited. Alice did not attend the meeting. If the boss did not want Alice there, and the boss did not invite her there, then she is going to be fired.  
 Prove by resolution that, "Alice is going to be fired."

:::::01/03/2025 E:::::