PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of Applied Mathematics and Computational Sciences

MSc Cyber Security Semester V

CONTINUOUS ASSESSMENT TEST I Date: 29.08.2025

23XCE7- Artificial Intelligence

Time: 1 Hour 30 min. **Maximum Marks: 40**

INSTRUCTIONS:

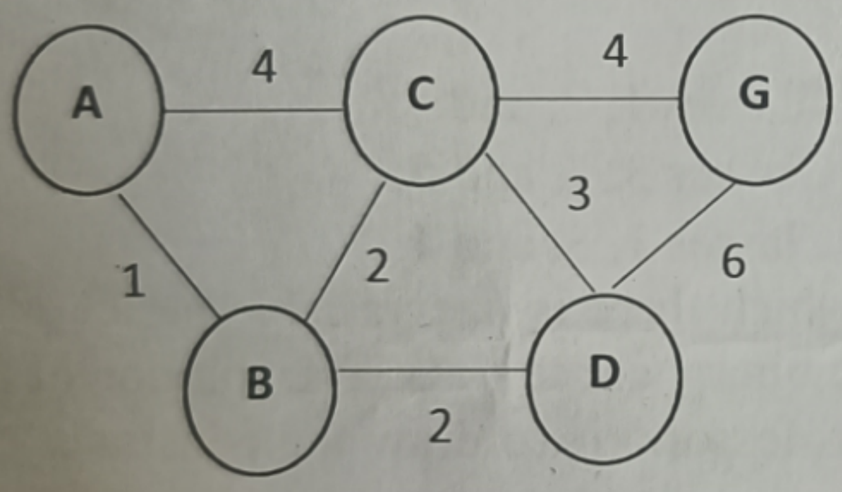
1. Answer **ALL** questions. Each question carries 20 Marks.
2. Subdivisions (a)(i) and (a)(ii) carries 2 marks each, subdivision (b) carries 6 marks each and subdivision (c) carries 10 marks each.
3. Course Outcome Table

Qn.1	CO1.	Qn.2	CO2.

1. (a) (i) Suppose that A* search produces an optimal solution for a state-space graph, the heuristic used in the search must be admissible. Prove/disprove the assertion with proper justification. **L2**

(ii) Characterize the environment of an agent that solves crossword puzzles. **L2**

(b) Consider the graph state space given below with A as the start state and G as the goal state. The numbers on the edges are the actual costs and the heuristic values are specified in the table.



State (n)	A	B	C	D	G
h(n)	7	6	2	2	0

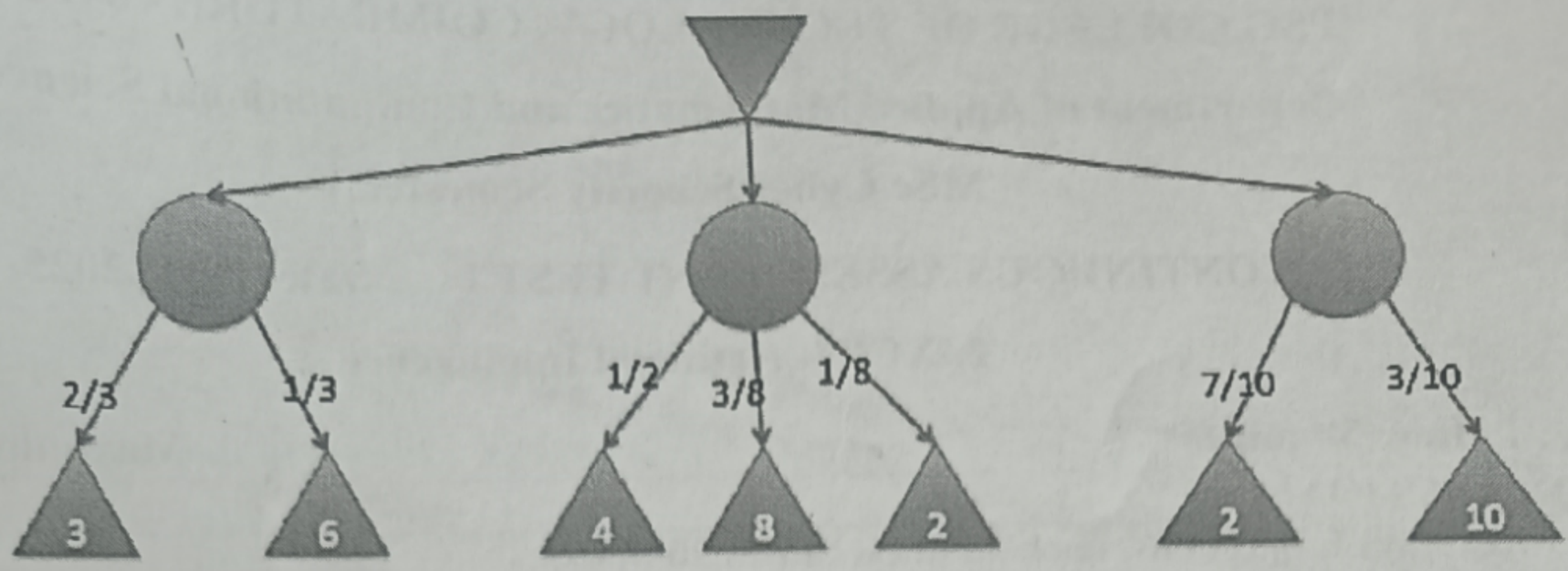
Perform A* search on the state space and find the path returned. Does it return the optimal path? If not, what will you change so that A* returns the optimal path? **L4**

(c) For the state space in question 1 (b), find the sequence of nodes expanded as well as the path returned by each of the following uninformed search algorithms: (i) Depth First search (ii) Uniform cost search (iii) Breadth first search (iv) Depth limited search (limit=1) (v) Iterative deepening depth first search.

- Use alphabetical order to break ties.
- Consider the edge cost as the depth of the state for algorithms other than uniform cost search. **L3**

2. (a) (i) Obtain the fitness function for the problem given below: **L4**
minimize $f(x)=x^2-2x$ where $2 \leq x \leq 6$

(ii) Consider the following expectiminimax tree in which circle nodes are chance nodes, the top node is a min node, and the bottom nodes are max nodes. Compute the expected values of the chance nodes. **L3**



(b) You are in charge of finalizing the schedule for the AI classes being offered for the semester. Your task is to assign classes to professors. There are 5 classes and 3 professors who are available for teaching these classes. You are constrained by the fact that each professor can only teach one class at a time and each professor is only qualified to teach a subset of the classes being offered. The classes are:

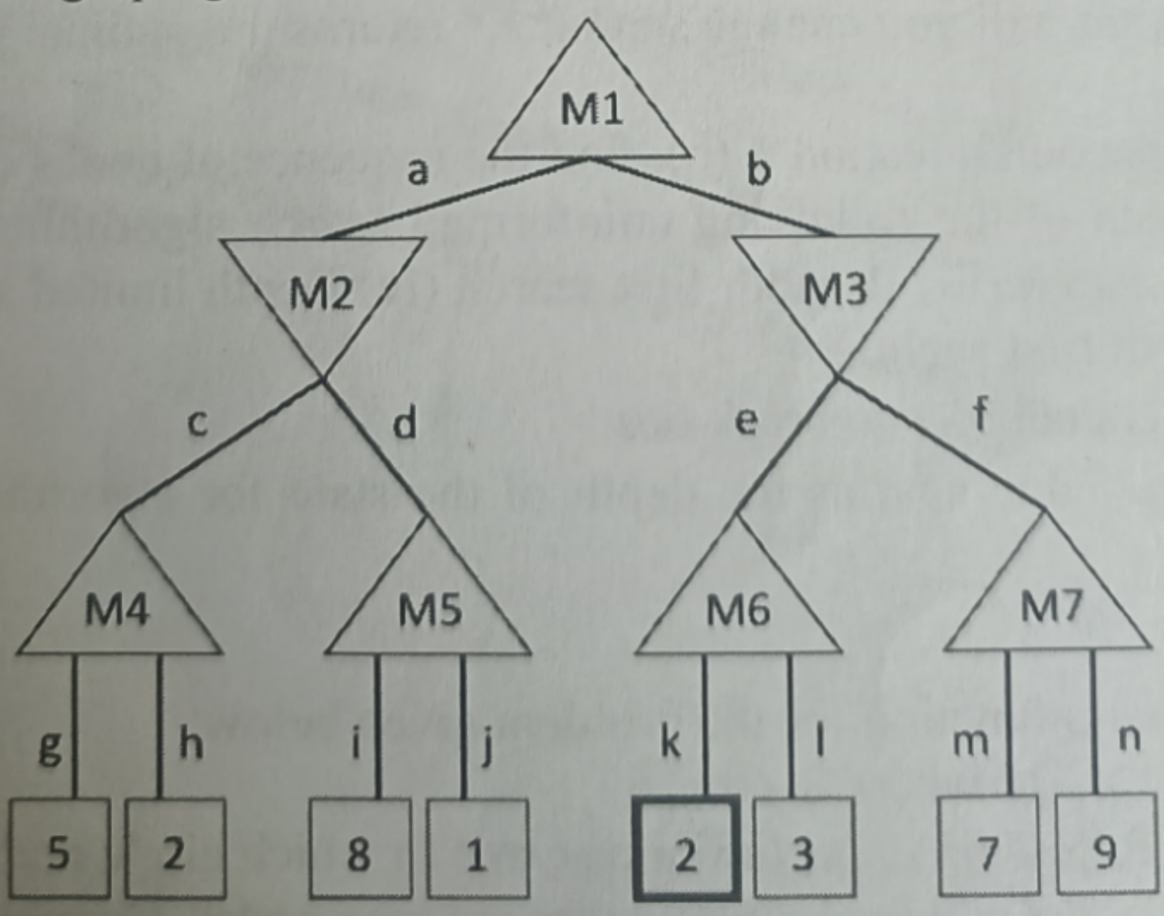
- Class 1 - Automated planning: scheduled for 8:00-9:00 am
- Class 2 - Intro to Artificial Intelligence: scheduled for 8:30-9:30 am
- Class 3 - Natural Language Processing: scheduled for 9:00-10:00 am
- Class 4 - Computer Vision: scheduled for 9:00-10:00 am
- Class 5 - Machine Learning: scheduled for 10:30-11:30 am

The professors are:

- Professor A, who is qualified to teach Classes 1, 2, and 5;
- Professor B, who is qualified to teach Classes 3, 4, and 5;
- Professor C, who is qualified to teach Classes 1, 3, and 4.

Formulate this problem as a CSP problem in which there is one variable per class, stating the domains (after enforcing unary constraints) and binary constraints. The solution of the problem shall determine the assignment of classes to professors. Also draw the constraint graph of the model. **L5**

(c) Observe the minimax graph given below. **L5**



(i) Apply Apha-Beta pruning and show the branches that are pruned.

(ii) What is the minimax value of the root (M1)? Also, write the minimax values of other nodes.

(iii) Suppose, the value of M1 has to be changed, what is the smallest integer that has to replace the highlighted 2 in the minimax tree?