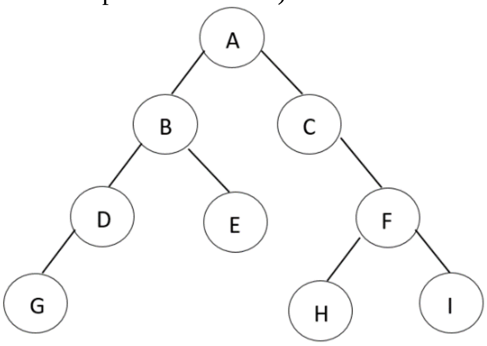
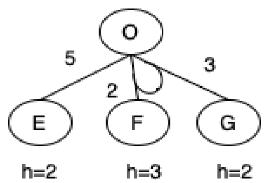
Roll No…………………….. **Name ………………** **Group No……** **Faculty…………**

Artificial Intelligence (UCS411) **Time: 20 mins** **MM:15** **Date:25/02/2025**

- **Note: Each Ques carries 1 mark except Q14 which is of 2 marks. Fill the answers in the space provided below. Answers will only be evaluated if written in below space. Over-written answers will not be evaluated.**

Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9	Q 10	Q 11	Q 12	Q 13	Q 14
A	**B**	**C**	**B**	**A**	**B**	**A,C**	**D**	**D**	**B**	**C**	**DEABCF, 186**	**C**	**2, ih**

Q. No.	Question
1	Perform **DFS with Iterative Deepening (DFS-ID)** on the following graph starting from node **A**. Which of the following shows the correct order of node traversal at different depths? (Assume depth starts from 0) a) Depth 1: A, B, C Depth 2: A, B, D, E, C, F Depth 3**:** A, B, D, G, E, C, F, H, I b) Depth 1: A, B, C Depth 2: A, B, D, C, E, F Depth 3: A, B, D, G, E, C, F, H, I c) Depth 1: A, C, B Depth 2: A, C, F, B, D, E Depth 3: A, C, F, I, H, B, D, G, E d) Depth 1: A, B, C Depth 2: A, C, F, B, E, D Depth 3: A, C, F, I, H, B, D, G, E 
2	If **C* = 500**, and **m = 5**, what is the **time complexity** of Uniform Cost Search (UCS) algorithm for finding the optimal solution? (Note: C* is the cost of the optimal path, m is minimum edge length) a) O(b^50) b) O(b^100) c) O(b^500) d) O(b^1000)
3	In Simple Hill Climbing, a randomly chosen successor is accepted if it has a higher heuristic function than the current state. Given 6 successor nodes with heuristic function f(N) values: A=12, B=18, C=15, D=17, E=10, F=14 If the current state has **f(S) = 15**, what is the probability that a randomly selected successor will be accepted? a) 1/2 b) 2/3 c) 2/6 d) 4/6
4	Consider a knowledge base (KB) consisting of the following axioms: 1. All birds have wings. 2. All birds fly, except penguins. 3. Tweety is a bird. 4. Tweety is a penguin or does not live in a cold region. 5. Tweety lives in a cold region. Which of the following combination of axioms prove that '**Tweety cannot fly'?** a) 1,3,4,5 b) 2,3,4,5 c) 1,2,3,5 d) 1,3,5
5	Which is the best path opted by the AO* algorithm for the given graph? a) O->E with path cost 7 b) O->E with path cost 10 c) O->F and G with path cost 10 d) O->F and G with path cost 7 
6	Consider the following Minimax tree with Alpha-Beta Pruning, where a Maximizer has an initial α = -∞ and a Minimizer has an initial β = +∞. If **Beta (β) at the right MIN node is 5**, what is the **maximum possible value of "?"** before pruning occurs? a) 2 b) 4 c) 6 d) 3 
7	Consider an optimization problem where the objective function exhibits multiple local optima. A researcher applies simulated annealing (SA) with an adaptive cooling schedule. Which of the following statements is/are **correct** regarding the performance and behavior of the SA algorithm in such a scenario? a) If the cooling rate is too high, the algorithm may get trapped in local optima, reducing the probability of finding the global optimum.

b) In a highly rugged search space with a large number of local optima, decreasing the probability of accepting worse solutions in early iterations can improve exploration.
c) A dynamically adaptive temperature adjustment can help the algorithm escape local optima more effectively compared to a fixed exponential cooling schedule, improving the chances of global convergence.
d) None of the above

8 In the Water Jug Problem, what are the minimum number of steps required to measure exactly 4 liters using a 5-liter jug and a 3-liter jug?

a) 3 b) 4 c) 2 d) 6

9 ‘Rescue Robots’ in disaster areas is an example of ______________ type of environment

a) stochastic and static
b) deterministic and static
c) deterministic and dynamic
d) stochastic and dynamic

10 In the Missionaries and Cannibals problem, where 3 missionaries and 3 cannibals must cross a river with a boat that can carry at most 2 people, what is the branching factor of the state-space graph in the worst case?

a) 2, since the boat can only go forward or backward.
b) 5, since there are 5 legal moves at most in any given state.
c) 6, since we can choose any 1 or 2 people from the 3 missionaries and 3 cannibals.
d) 10, since all combinations of moving 0, 1, or 2 people must be considered.

11 Consider two jugs of 2 liters and 5 liters. The goal is to measure exactly 4 liters. Using Best-First Search with the heuristic h(n)="max (|jug1_value - 4|, |jug2_value - 4|)" (i.e. maximum of absolute difference of 4 from both jugs), which state will be expanded first if the currently explored state is (0,0), and states in Open list are (1,0), (0,5), (2,1) and (0,2)? (Note: h(n) is a minimizer function)

a) (2,0)
b) (0,5)
c) (2,1)
d) (0,2)

12 The tour generated by Greedy Heuristic for a Travelling Salesperson Problem (TSP) with six cities is ________________________ and total cost incurred is ______________. The cost to travel from each city to every other city is given in the adjacency matrix. Salesman will start from city D. (Note: Write down order of list of cities traversed separated by comma).

	A	B	C	D	E	F
A	0	10	20	30	40	50
B	10	0	31	21	51	41
C	20	31	0	12	59	100
D	30	21	12	0	5	8
E	40	51	59	5	0	69
F	50	41	100	8	69	0

13 In a graph where nodes represent locations and edges represent paths between them, suppose we are using the A* algorithm to find the shortest path from a start node S to a goal node G. Given the following conditions:
1. The edge costs between nodes are non-negative.
2. The heuristic h(n) is admissible (i.e., it never overestimates the true cost to reach the goal).
3. The heuristic is consistent (i.e., for any node n and any neighbor n', h(n) <= c(n, n') + h(n'), where c(n, n') is the cost of moving from n to n'.
Which of the following statements about the A* algorithm is correct?

a) A* can sometimes fail to find the optimal path if the heuristic is consistent but not admissible.
b) A* will always explore nodes with the smallest heuristic value h(n) first, regardless of the cost so far to reach them.
c) If two nodes have the same f(n) = g(n) + h(n), A* will explore them in the order they were inserted into the open list.
d) A* does not guarantee optimality if the heuristic function is not consistent, even if it is admissible.

14 The minimum value of beam width (β) required to find the complete solution in the given graph using beam search algorithm is _________________ and nodes in the Open list at step 3 are _______________? (Note: ‘a’ is the start node and ‘g’ is the goal node, consider step numbering starts from 1)