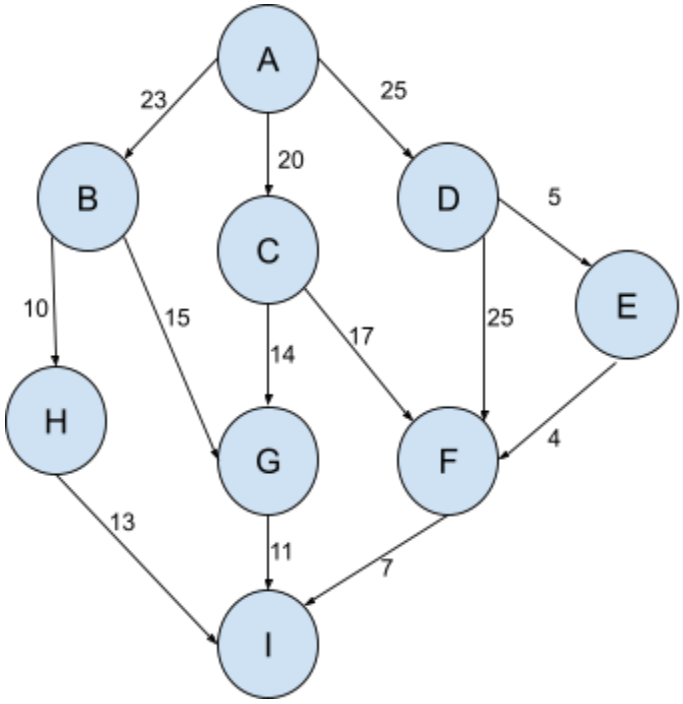
CSE 422: Artificial Intelligence
Summer 2025
Section: 26
Assignment - 01
(35 Marks)
Deadline: 08 July 2025

Question 01 (13 Marks)



a) Construct a heuristic table for all nodes, ensuring that the heuristic values are admissible. Justify your calculations for each node to demonstrate admissibility. [3]
b) Use the Greedy Best-First Search algorithm to find the shortest path from start node A to goal node I. Show each step of the process. [2]
c) Using the heuristic table from part (a), verify whether the heuristics are consistent. If they are not consistent, modify them to satisfy the consistency condition. Show calculations for every edge to support your answer. [3]
d) Using the heuristic table from part (c), apply the A* Search algorithm to find the shortest path from start node A to goal node I. Show each step of the process. [3]
e) Evaluate Greedy Best-First Search and A* Search algorithm. [2]

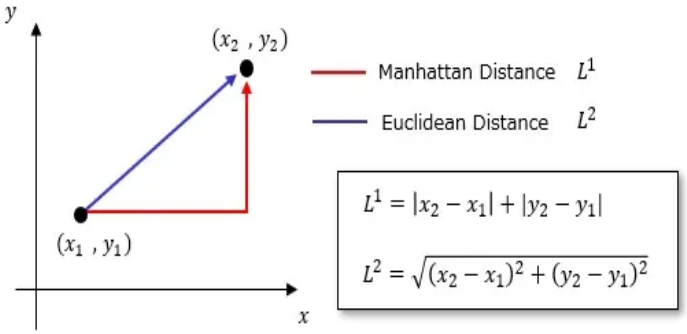
Question 02 (6 Marks)

While navigating a 6×6 grid on Mars, a rover must travel from its base camp at the bottom-left corner (5,0) to a communication tower at the top-right corner (0,5). The rover can move horizontally or vertically at a cost of 1 per move, and diagonally at a cost of √2. It uses the A* search algorithm for path planning and is equipped with two heuristic functions: $h_1(n)$: Manhattan distance to the goal; $h_2(n)$: Euclidean distance to the goal.
(***Justify the answers with examples from at least two different nodes in the grid.)***

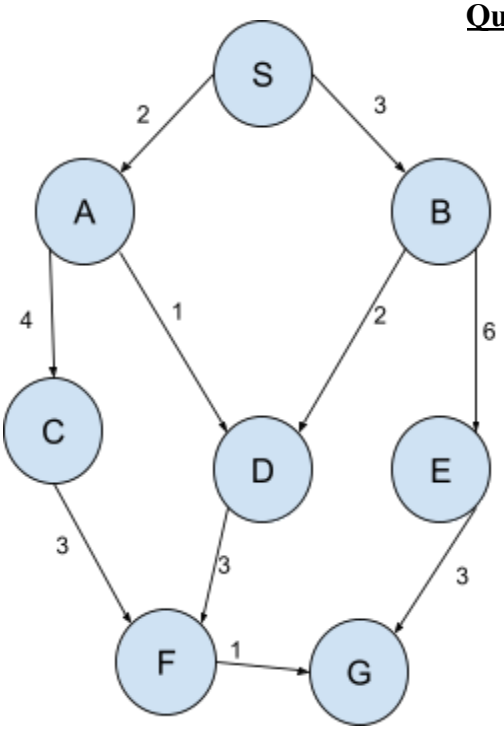
a) Are both heuristics admissible? (2)

b) Which heuristic will likely result in fewer node expansions during A* search? (2)

c) What will happen if $h_1(n)$ is multiplied by 1.4? Provide your explanation with example node calculations. (2)



Question 03 (10 Marks)



Node	$h_1(n)$	$h_2(n)$	$h_3(n)$
S	6	7	5
A	4	5	3
B	5	5	4
C	3	3	2
D	2	3	1
E	3	2	2
F	1	1	1
G	0	0	0

a) Based on the above information, which heuristic function (h_1, h_2, or h_3) is better suited for the A* search algorithm, and why? (Show calculation for each node) [6]

b) Using the heuristic table from part (a), apply the A* Search algorithm to find the shortest path from start node A to goal node G. Show each step of the process. [4]

Question 04 (6 Marks)

A drone is trying to reach the highest point on a 2D elevation map using the Hill Climbing algorithm, which moves to neighboring positions only if they offer a higher elevation. However, it sometimes gets stuck at local peaks and fails to reach the highest point. Later, Simulated Annealing is used, which occasionally allows downward moves to escape such situations.

a) Briefly explain advantages, disadvantages and the remedies of Hill Climbing in this context. [3]

b) How does Simulated Annealing overcome the limitation of Hill Climbing? Explain the role of temperature (T) and how it affects the probability of accepting worse moves. [3]