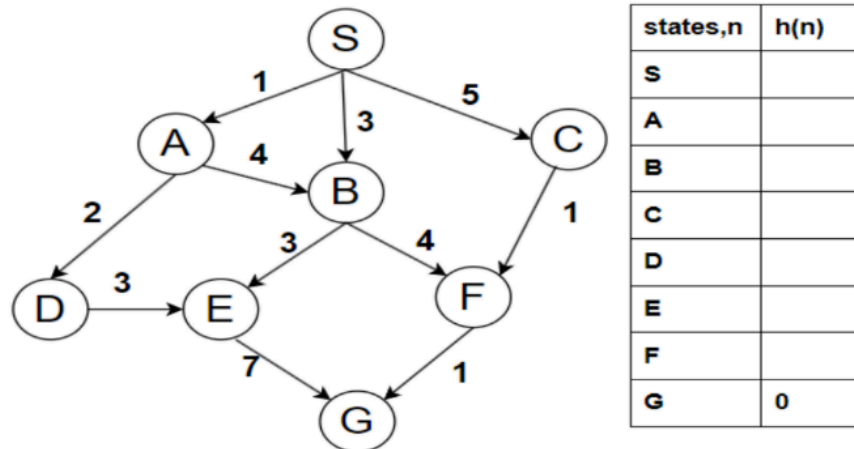


1.

A. For the following state space tree define the heuristic values for the following states such that it is admissible.

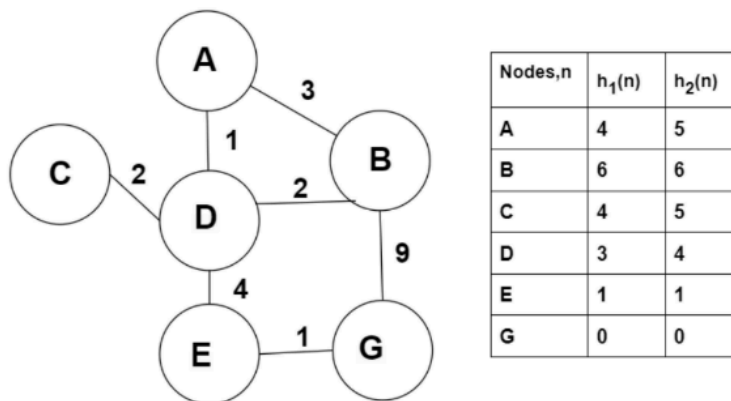


B. Perform Best First Search and A* search algorithm on the following graph with the defined heuristic values.

C. Now comment on the heuristic values defined whether it is consistent or no by showing the calculations needed. And correct the heuristic values to be consistent.

D. For a state, from which the goal node is unreachable, what do you think the actual path cost and heuristic value should be?

2.



A) From the above context, please explain briefly which heuristic function would be better?

B) Now after choosing the heuristic, perform A* Search

C) Demonstrate if the chosen heuristic is consistent or not.

3.

You are working with a 6×6 grid world where moving horizontally or vertically costs 1, while diagonal moves cost $\sqrt{2}$. A* search is applied from the top-left cell to the bottom-right cell.

Two heuristics are defined as follows:

- **hA(n)**: Manhattan distance $\rightarrow |X_{goal} - X_n| + |Y_{goal} - Y_n|$
- **hB(n)**: Euclidean distance $\rightarrow \sqrt{\{X_{goal} - X_n\}^2 + \{Y_{goal} - Y_n\}^2}$

Now answer the following:

- Are these two heuristics guaranteed to never overestimate the actual path cost to the goal? Provide reasoning with an example involving two specific positions on the grid.
- If A* is executed using both heuristics separately, which one is expected to result in fewer node explorations in this environment? Support your answer with a brief explanation.
- Suppose hA(n) is scaled by 1.1. Will it still be considered admissible? Will A* continue to return the shortest path under this condition? Justify your response.

4.

- Explain Why GBFS is suboptimal with an example graph/tree search simulation.
- Explain Why GBFS is incomplete and how can it be solved?
- Is A* optimal? Give an example graph to illustrate
- Is A* Complete? Give an example graph to illustrate
- What is the difference between graph search vs tree search in Searching Algorithm?
- What is heuristic dominance? And why we prefer one heuristic over another for this case.