1. Find the most cost-effective path to reach the final state from initial state using A* Algorithm. Consider g(n) = Depth of node and h(n) = Number of misplaced tiles.

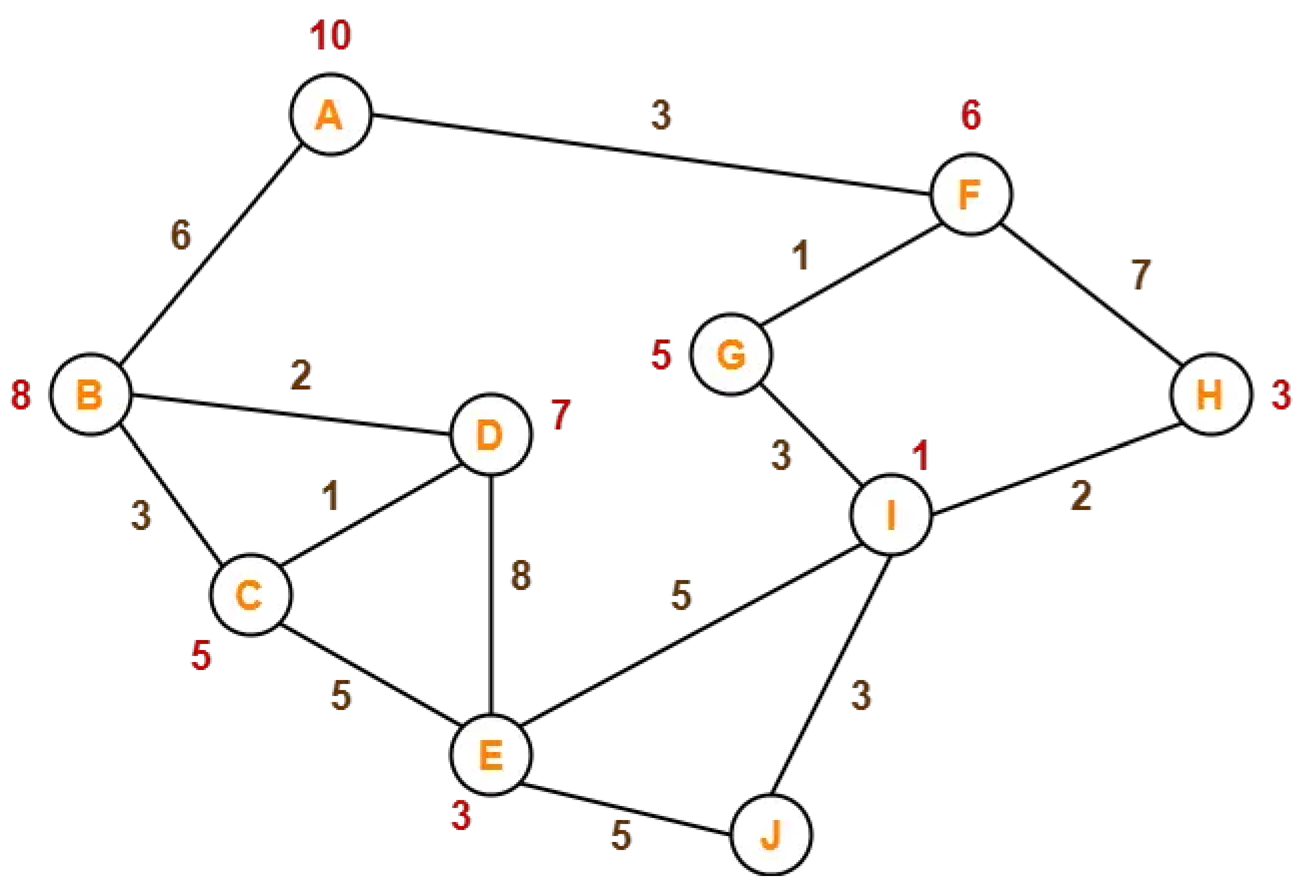
2	8	3
1	6	4
7		5

Initial State

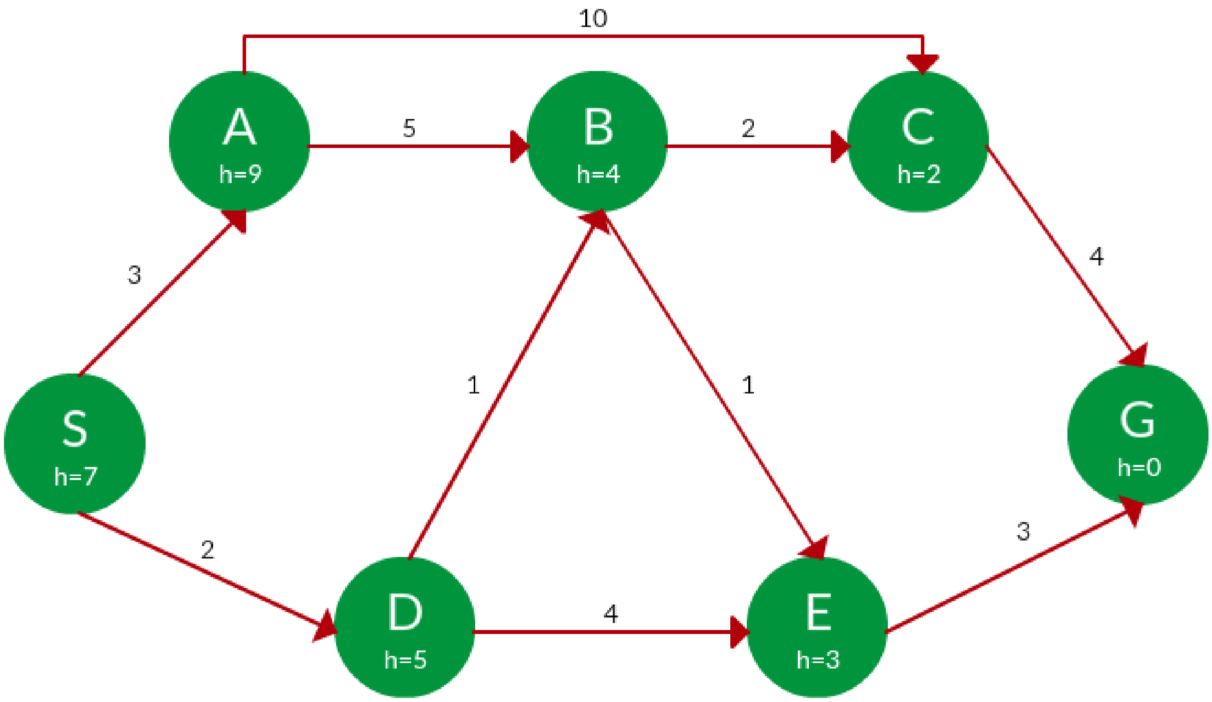
1	2	3
8		4
7	6	5

Final State

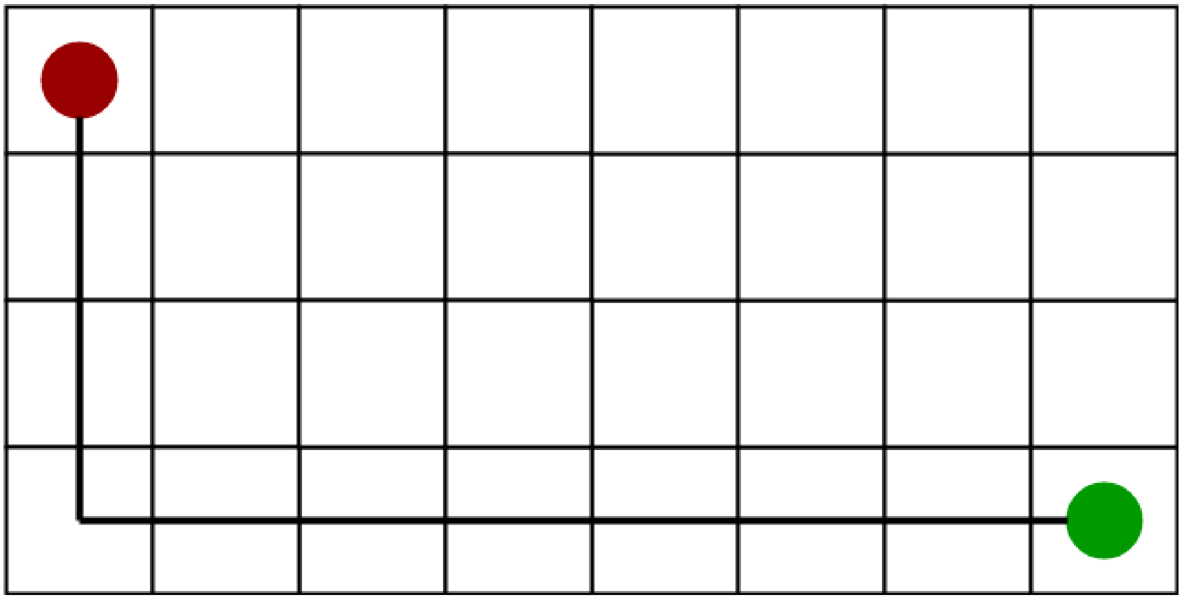
2. The numbers written on edges represent the distance between the nodes. The numbers written on nodes represent the heuristic value. Find the most cost-effective path to reach from start state A to final state J using A* Algorithm.



3. Find the optimal path from S to G using A* search



4. Find the shortest route from red spot to green spot. The given path is just an example of a path. Use A* search algorithm



5. During A* search the leaves of the search tree contain a suboptimal goal and an ancestor of the optimal goal along with other nodes. Which node will A* search select and why?

   A* search will choose the node with the lowest f-score among the suboptimal goal, the ancestor of the optimal goal, and any other nodes at the leaves of the search tree. The specific node selected depends on the combination of g-scores, h-scores, and the associated paths of these nodes.

6. There are three nodes in A* search tree having g1 = 200, g2 = 250 and g3 = 270. The estimated distances of these nodes from the goal are 150, 175 and 130 respectively. If the cost of the optimal path is 395, which nodes will be expanded and which one will not be expanded? Justify your answer

7. What is the advantage of IDA* search over A* search?

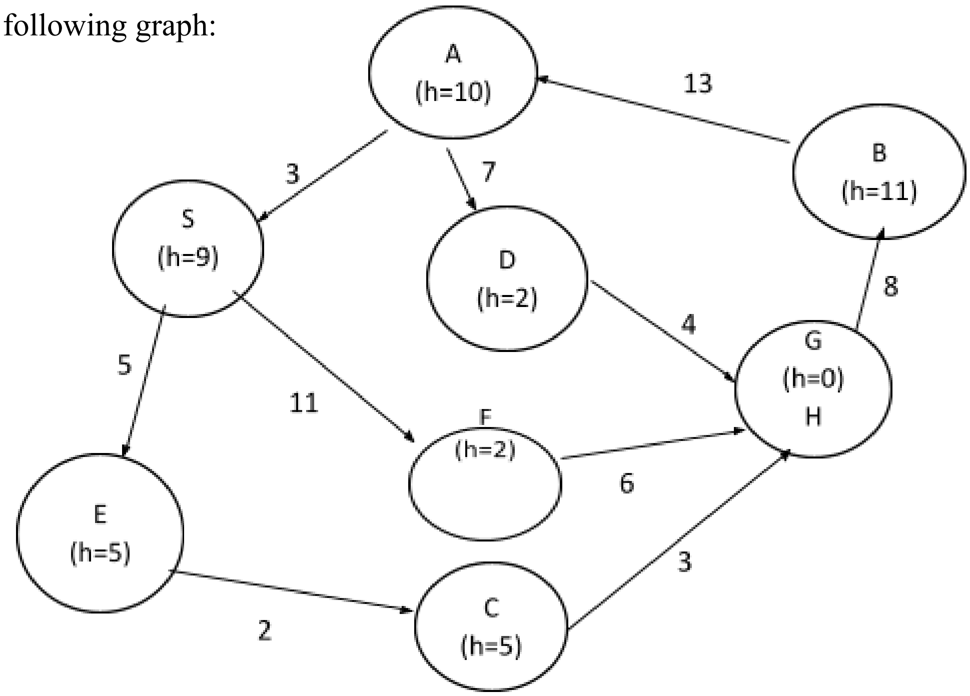
8. In a search tree what pieces of information are contained in a node?

9. What is the difference between path cost and search cost?

10. Both A* and UCS find optimal solution. Then in what respect A* search is better than UCS?

11. Why larger valued heuristic expands less number of nodes compared to less valued heuristic?

12. Consider the following graph:



Here **S** is the starting node and **G** is the goal node. Now change only the heuristic values of **any two** nodes so that the heuristic values become both admissible and consistent. Mention the updated values and corresponding node names.

13. Suppose you have two heuristic functions **h1 and h2**, both of which are **admissible**. You have decided to create several new heuristic functions defined as follows:
    - h3(n) = 0
    - h4(n) = 2 × h1(n)
    - h5(n) = h2(n)/2
    - h6(n) = (h1(n)+h2(n))/2
    - h7(n) = max(h1(n), h2(n))
    - h8(n) = min(h1(n), h2(n))

    Now answer the following questions:

    i. Which heuristic is possibly inadmissible?
    ii. Among h5 and h6 which one is dominant?
    iii. Which heuristic will expand the maximum number of nodes?
    iv. In your opinion which heuristic is the best?

14. **The missionaries and cannibals** problem is usually stated as follows. Three missionaries and three cannibals are on one side of a river, along with a boat that can hold one or two people. Find a way to get everyone to the other side without ever leaving a group of missionaries in one place outnumbered by the cannibals in that place.

a. Formulate the problem precisely, making only those distinctions necessary to ensure a valid solution. Draw a diagram of the complete state space.
b. Implement and solve the problem optimally using an appropriate search algorithm. Is it a good idea to check for repeated states?

15. You have to measure 1 liter water using a 5 liter and 3 liter can. You can fill in the can with water from tap, you can throw water from a can on the ground and you can pour water from a can into another. Solve the problem using Uniform cost search algorithm