Problem Set – 01

1. Assuming **S** and **G** to be the *start* and *goal* states respectively, construct search tree for the following graph. Also indicate the path length (cost) to each node in the search tree. The numbers shown along each link are step costs.

2. For the search tree shown below, simulate each of the following algorithms for the goal state **G.** The numbers along each link represent the corresponding step costs.
   a) Depth-First Search
   b) Breadth-First Search
   c) Iterative Deepening Search
   d) Uniform Cost Search

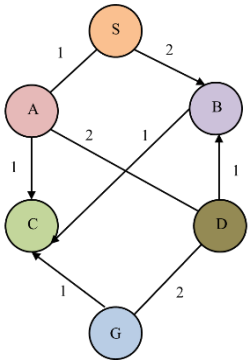


Fig. for Q1

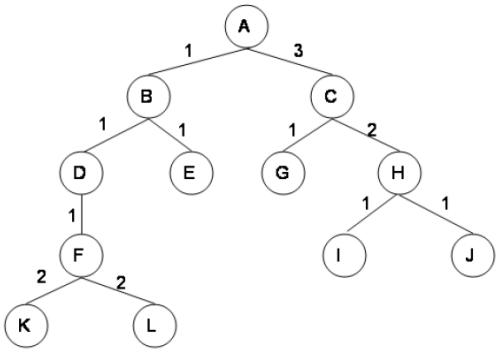


Fig. for Q2

3. Let **A** be the start state and **G** be the goal state in the following graph. The numbers on the links represent step costs and the numbers next to the states are heuristics.
   a) Simulate A* search with a strict expanded list.
   b) Are the heuristics admissible? Give reason for your answer.
   c) Are the heuristics consistent? Give reason for your answer.
   d) Is the path found by A* with strict expanded list optimal? If not, briefly explain the reason for sub-optimality.
   e) What change(s) would you suggest in the heuristics to obtain optimal behavior of A* using strict expanded list in part a)?

4. Let **J** be the goal state in the following graph. The numbers on the links represent step costs and the numbers next to the states B, C and D are their heuristics. Heuristics of all other states are zero. Simulate each of the following algorithms.
   a) Breadth-First Search
   b) Depth-First Search
   c) Iterative Deepening Search
   d) Best-First Search
   e) A* Search

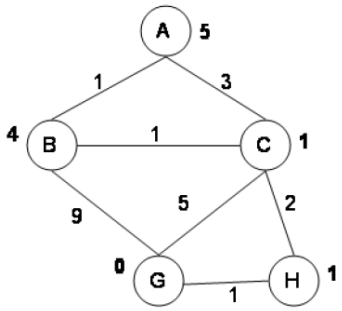


Fig. for Q3

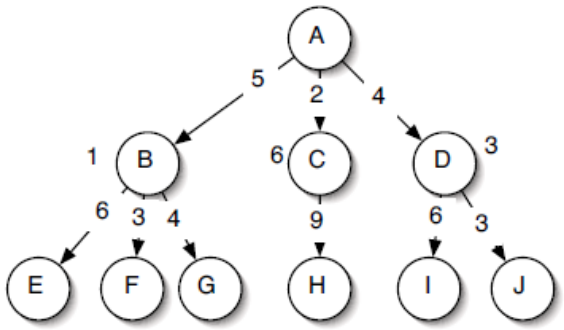


Fig. for Q4

5. Consider the 8-puzzle given below. If true cost to solve the problem is 20 steps. Which of the following heuristics will be admissible?

   a) Total number of misplaced tiles
   b) Sum of rectilinear distance
   c) Sum of permutation inversions

8	6	7
2	5	4
3		1

S

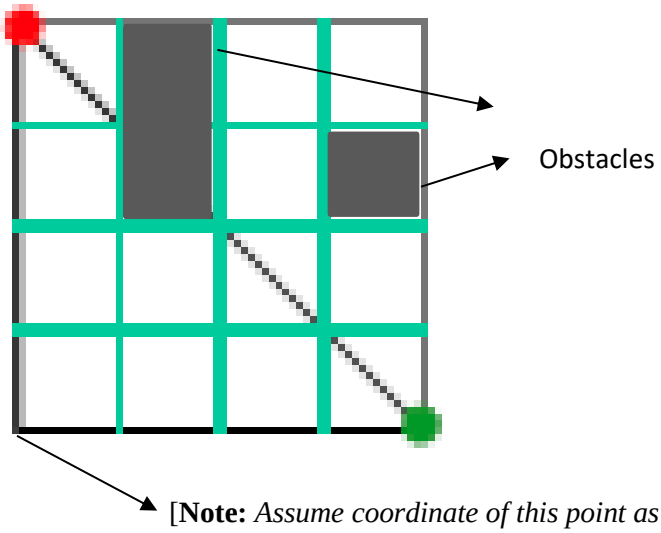
6	4	7
8	5	
3	2	1

G

6. Consider given path for robot navigation. If each small square has a side length of 1 unit. Calculate which of the following distance(s) can be used as admissible heuristic, if robot has to reach at destination ● from the beginning position ●

   - Rectilinear distance -- $|x_2-x_1| + |y_2-y_1|$
   - Euclidean distance -- $\sqrt{(x2-x1)^2 + (y2-y1)^2}$

   a) If moving along diagonals is not allowed.
   b) If moving along diagonals is allowed.



[**Note:** *Assume coordinate of this point as* (0,0)]

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