

Assignment- 1

Instructions:

- ☞ *The answers must be written on of A4 sized paper or loose sheets with proper margins. (HANDWRITTEN)*
- ☞ *Assignment must be submitted within specified deadline and with proper cover page by clearly mentioning subject name, assignment number , submitters information (name, roll-number and section)*
- ☞ *The answers should be written after understanding the concepts and blindly copying from others is strictly discouraged.*

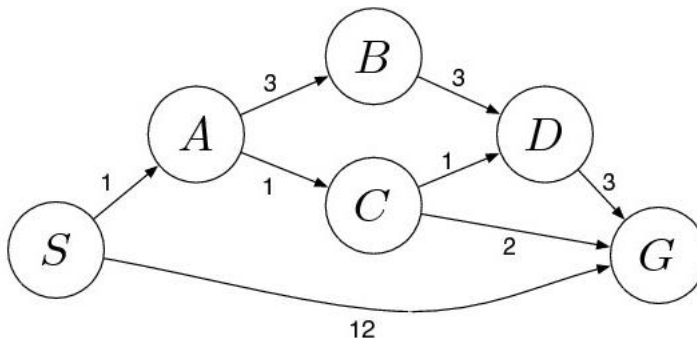
Recommendations:

- ☞ *Students are highly recommended to follow text-books and internationally recognized reference books, research papers and authentic websites/blogs/tutorials.*

1. Solve the following problems:

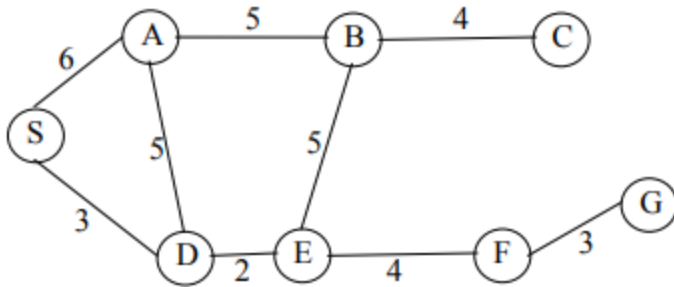
- 1.1. Consider a state space where the start state is number 1 and each state k has two successors: numbers $2k$ and $2k + 1$.
 - a) Draw the portion of the state space for states 1 to 15
 - b) Suppose the goal state is 11. List the order in which nodes will be visited for breadth-first search, depth-first search, depth-limited search with limit 3, and iterative deepening search.
- 1.2. Differentiate between blind (uninformed) and heuristic (informed) search strategies. Explain why uniform-cost search is blind search and hill climbing search is informed search.
- 1.3. What is heuristic function? List any three heuristic functions relating with problem domains.
- 1.4. Remember that uniform-cost search expands the node with the lowest path cost, and that (greedy) best-first search tries to expand the node closest to the goal. Now explain (prove) each of the following statements is true:
 - a) Breadth-first search is a special case of uniform-cost search.
 - b) Uniform-cost search is a special case of A* search
 - c) Greedy –best – first search is special case of A* search.
- 1.5. Discuss about conditions for optimality (for searching algorithms): *Admissibility* and *consistency*. Write about the optimality of A* search.

- 1.6. Explain the scenario where local-search is preferred over systematic-search. Write the algorithms for General– Hill-Climbing search and Steepest-Ascent-Hill- Climbing search. List the problems related with Hill-Climbing-Search and mention possible solutions to overcome them.
- 1.7. Discuss the main idea about Simulated Annealing algorithm in searching. Write the algorithm and explain.
- 1.8. What do you mean by admissible heuristic? Consider the following state space representation where S is the start state and G is the goal state. The heuristics of the states are given in the table and the weights on the edges represent path costs. Now show :
- How A* search is used to find the goal state
 - How Uniform-Cost search used to find the goal state
 - How Steepest-Ascent-Hill-Climbing search is used



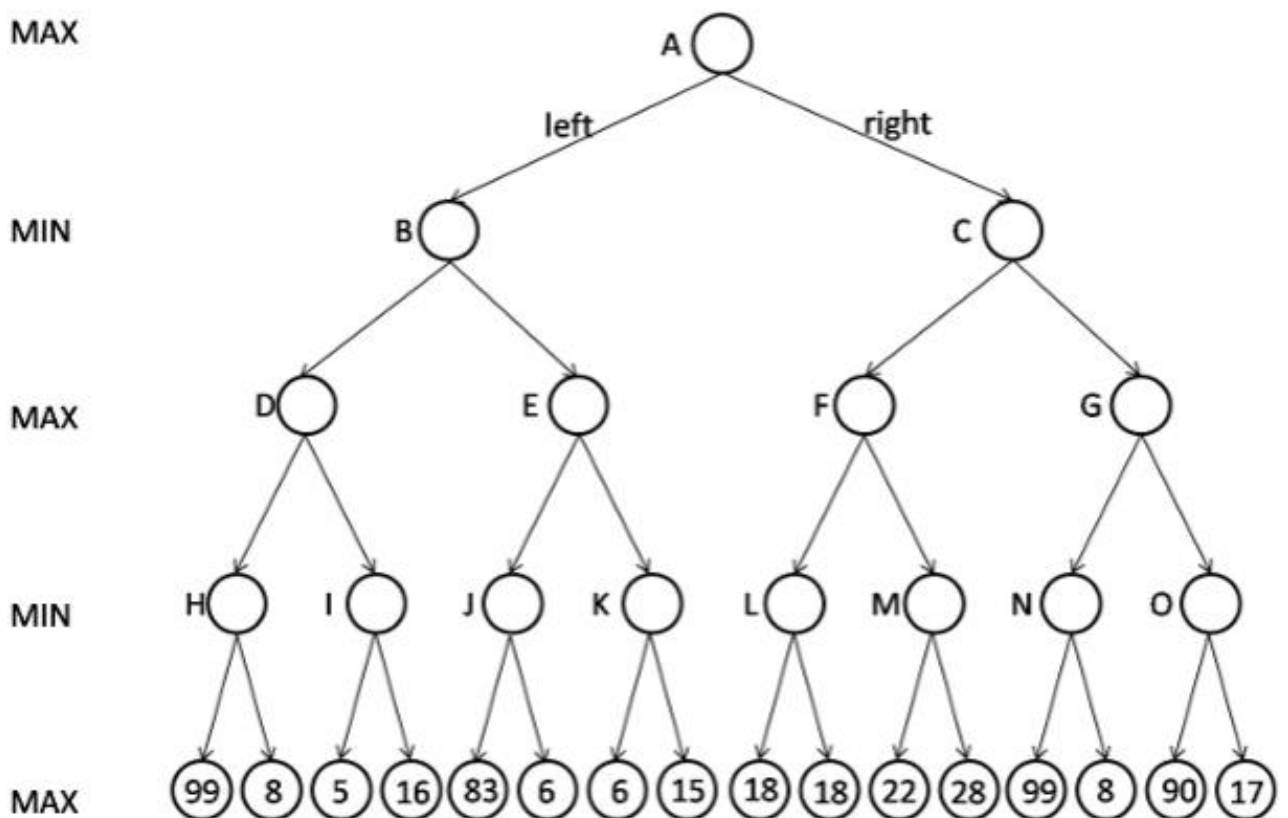
State	Heuristic value, $h(\text{State})$
S	4
A	2
B	6
C	2
D	3
G	0

- 1.9. Consider the following state space representation where S is the start state and G is the goal state. The heuristics of the states are given in the table and the weights on the edges represent path costs. Now show :
- How greedy best first search is used to find goal state.
 - How A* search is used to find the goal state
 - How Uniform-Cost search used to find the goal state
 - How Steepest-Ascent-Hill-Climbing search is used



State	Heuristic value, h(State)
S	12
A	8
B	7
C	5
D	9
E	4
F	2
G	0

- 1.10. Consider the following game tree and trace Alpha-Beta Pruning Algorithm to find the nodes to be pruned? How many nodes are pruned?



1.11. Consider following map & heuristic table and implement given search algorithms

- a) BFS (for Arad to Bucharest)
- b) Uniform cost search (for Sibiu to Urziceni)
- c) DFS(for Sibiu to Hirsova)
- d) Depth limited search (for Oradea to Neamt) [assume limit = 4]
- e) Iterated deepening search (for Oradea to Neamt)
- f) GBFS (for Arad to Bucharest)
- g) A* (Steepest-Ascent-Hill-Climbing search)
- h) A* (for Oradea to Craiova)
- i) General -Hill-Climbing (for Oradea to Craiova)
- j) Steepest-Ascent-Hill-Climbing (for Oradea to Craiova)

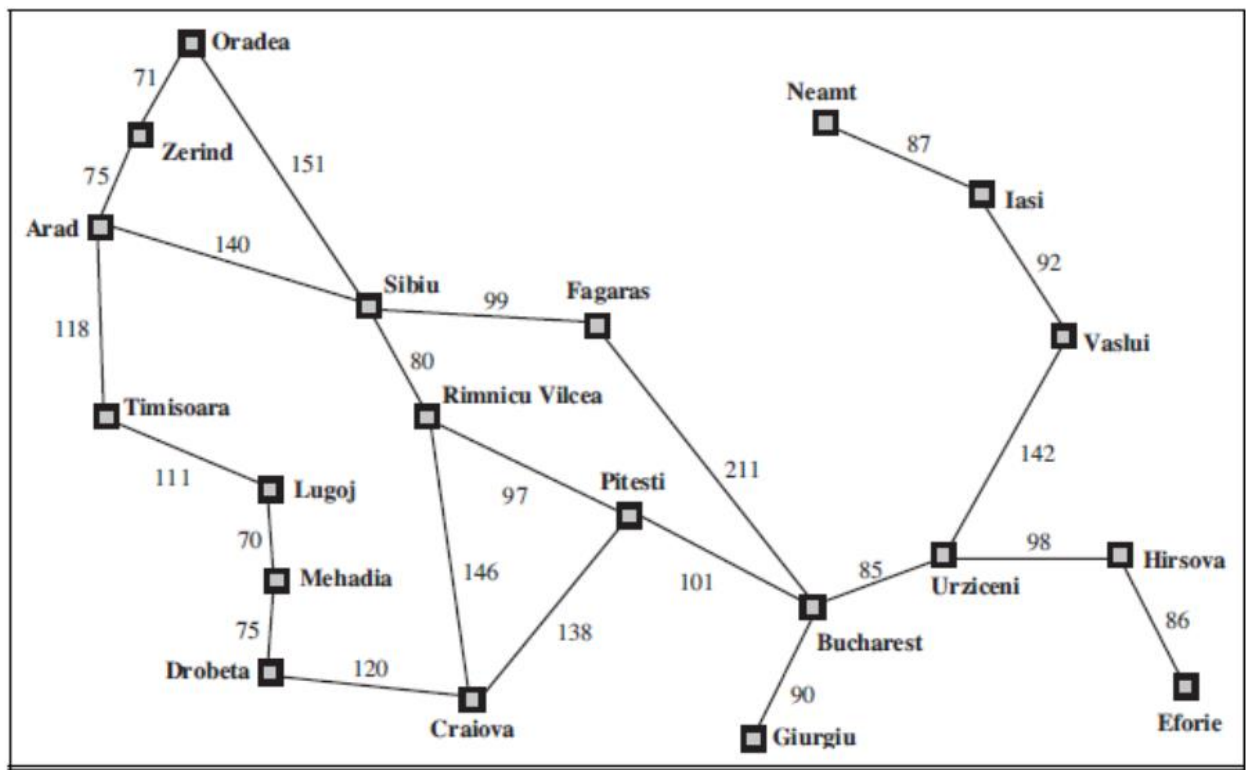


Figure: Graph of cities.

Arad	366	Mehadia	241
Bucharest	0	Neamt	234
Craiova	160	Oradea	380
Drobeta	242	Pitesti	100
Eforie	161	Rimnicu Vilcea	193
Fagaras	176	Sibiu	253
Giurgiu	77	Timisoara	329
Hirsova	151	Urziceni	80
Iasi	226	Vaslui	199
Lugoj	244	Zerind	374

Figure: Values of hSLD—straight-line distances to Bucharest.