

# **CIS 604: Techniques in Artificial Intelligence.**

## ***Exercise Set 1***

**Submission due: September 25th, 2013.**

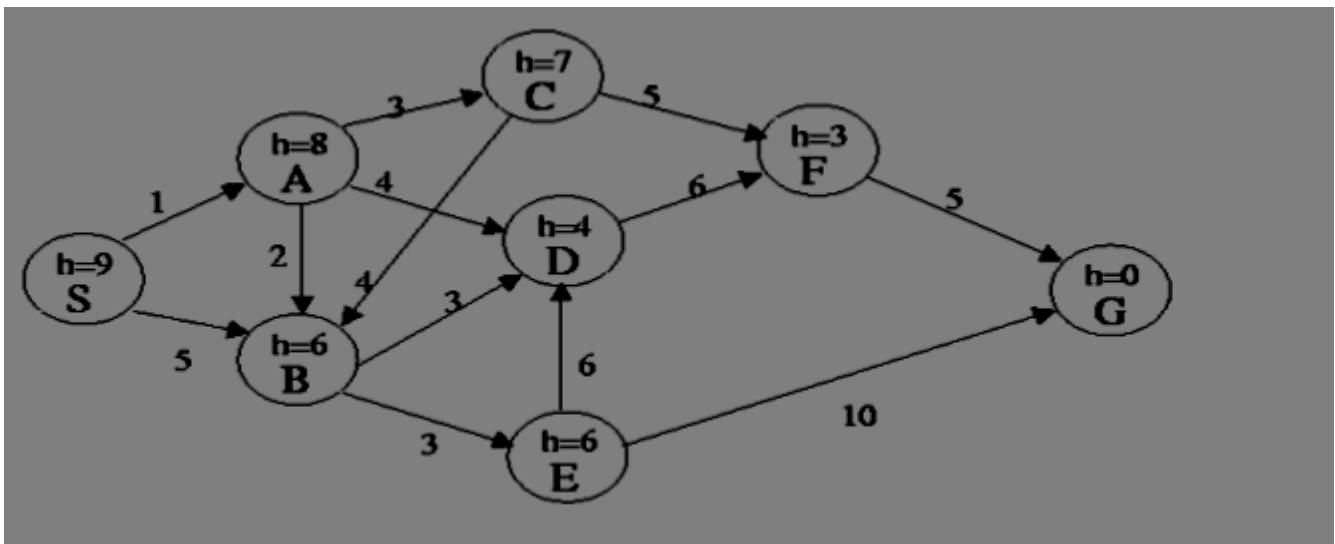
# **1. Agents and Search**

**Answer true or false:**

- a.) Breadth-first search is an optimal search algorithm.
- b.) A non- deterministic environment is one where the agent cannot observe the current state.
- c.) Breadth-first search is complete if the state space has infinite depth but finite branching factor.
- d.) Depth-first iterative deepening always returns the same solution as breadth-first search if the branching factor  $b$  is finite and the successor ordering is fixed.

# **2.**

In the problem shown in the figure below, the start state is S, and the goal state is G. The transition costs are next to the edges, and the heuristic estimate,  $h$ , of the distance from the state to the goal is in the states node. Assume ties are always broken by choosing the state which comes first alphabetically.



**Answer the following questions:**

- What is the order of the states expanded using Depth First Search? Assume the state which comes first alphabetically. Assume DFS terminates as soon as it reaches the goal state.
- What is the order of states expanded using Breadth First Search?
- What is the order of expanded states expanded using Best First Search? Assume BFS terminates as soon as it reaches the goal state.
- What is the order of states expanded using A\* search?
- What is a least cost path from S to G?

**3.**

- Show that given that the heuristics is admissible, A\* tree search is optimal.
- Prove that uniform-cost search and breadth-first search with constant step costs are optimal when used with the Graph- Search algorithm.

## 4.

- a. Data structures are central to implementing search algorithms. Familiarity with LIFO(stack), FIFO(queue) and priority queues is very essential. The “searchProblems.py” file contains implementation of a stack and priority queue. Implement the FIFO.
- b. A typical search problem is defined by its search state, goal state and a map of the successors states. Study the implementation of the GraphProblem class in the file provided.
- c. Implement the graph search algorithm. The tree search algorithm is already implemented in the file.
- d. Heuristics is fundamental to the A star search. For the Romania problem, implement the Euclidean distance function.

Note: The code has already been structured. You just have to fill in your codes into the indicated gaps.