Homework 1
CS4100/5100, Fall 2014

Your Name:

1. In what order do the following search methods (assume you use the graph search version) expand the nodes in the graph below (assume that nodes are added to the stack/queue in alphabetical order)? The agent starts at node a and must reach node g.

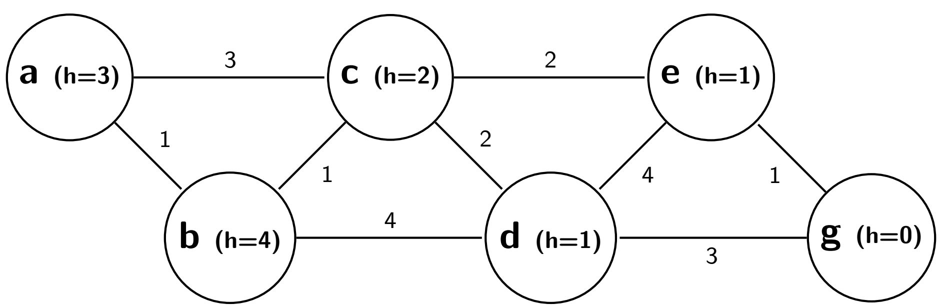
a. BFS (5 pts)?

b. UCS (5 pts)?

c. DFS (5 pts)?

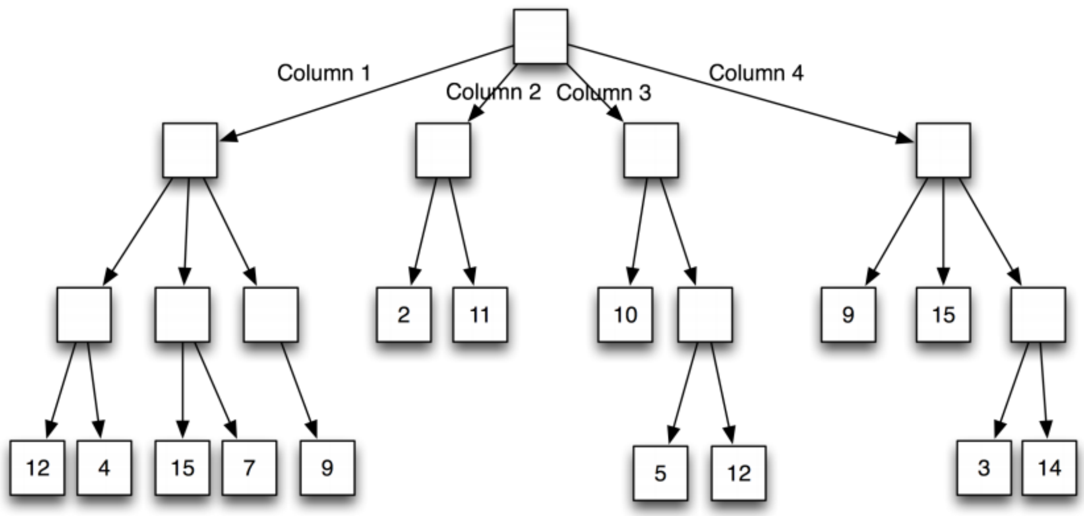
d. Greedy search (5 pts)?

e. A* (5 pts)?



2. There are two players playing a game (Max and Min). Below is the minimax and $\alpha - \beta$ search tree for this game. The leaves are labeled with their static evaluation values.

a) (5 pts) Use Minimax to evaluate the game tree below. Fill in the blanks in the figure below with each nodes Minimax value.



b) (5 pts) What moves does Minimax say the maximizer should make? Is it column 1, column 2, column 3, or column 4?

3. (Russel and Norvig, Exercise 3.3) Suppose two friends live in different cities on a map, such as the Romania map shown in Figure 3.2. On every turn, we can simultaneously move each friend to a neighboring city on the map. The amount of time needed to move from city i to neighbor j is equal to the road distance $d(i, j)$ between the cities, but on each turn the friend that arrives first must wait until the other one arrives (and calls the first on his/her cell phone) before the next turn can begin. We want the two friends to meet as quickly as possible.

a. (5 pts) Write a detailed formulation for this search problem. (You will find it helpful to define some formal notation here.)

b. (5 pts) Let $D(i, j)$ be the straight-line distance between cities i and j. Which of the following heuristic functions are admissible? (i) $D(i, j)$; (ii) $2D(i, j)$; (iii) $D(i, j)/2$.

c. (5 pts) Are there completely connected maps for which no solution exists?

d. (5 pts) Are there maps in which all solutions require one friend to visit the same city twice?

4. (Russell and Norvig, Exercise 5.7) Prove the following assertion: For every game tree, the utility obtained by MAX using minimax decisions against a suboptimal MIN will be never be lower than the utility obtained playing against an optimal MIN (10 pts). Can you come up with a game tree in which MAX can do still better using a suboptimal strategy against a suboptimal MIN (5 pts)?

5. Do Exercise 5.8 in Russel and Norvig (5 pts for each part).