Section 1: Search *
CS4100/5100, Fall 2015

Your Name:

1. Consider the two graphs shown in Figures 1 and 2. In what order do the following search methods (assume you use the graph search version) expand the nodes for each graph (assume that nodes are added to the stack/queue in alphabetical order)? The agent starts at node a and must reach node g.

1.a. UCS (5 pts)?

1.b. DFS (5 pts)?

1.c. Greedy search (5 pts)?

1.d. A* (5 pts)?

*This assignment may include material copied or derived from (with permission) the UC Berkeley CS188 Intro to AI course materials and/or Artificial Intelligence: A Modern Approach, Russell and Novig

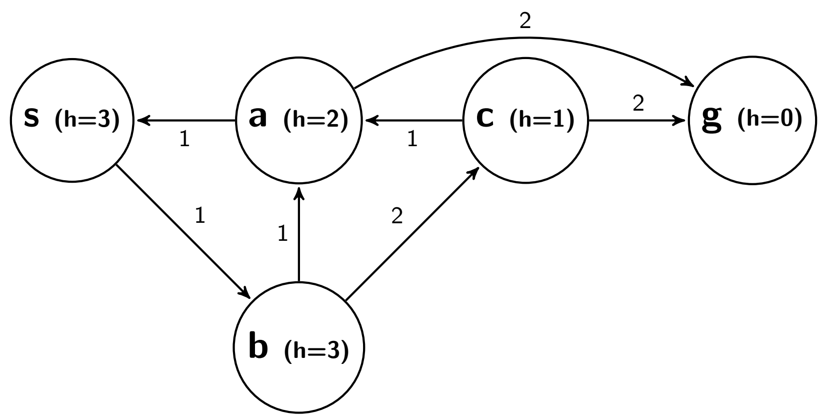

Figure 1

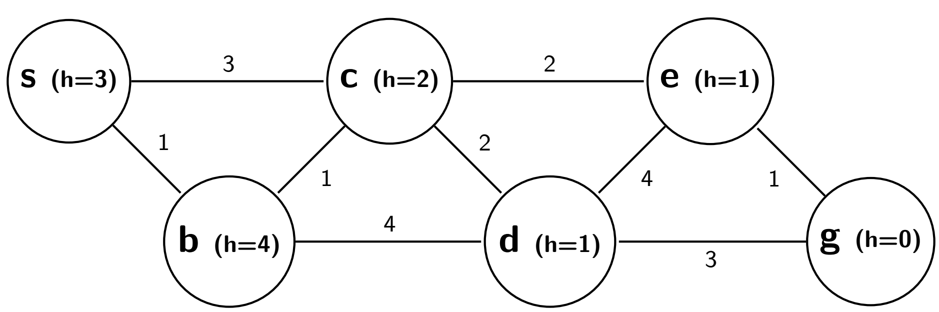

Figure 2

2. Imagine a car-like agent wishes to exit a maze like the one shown below:

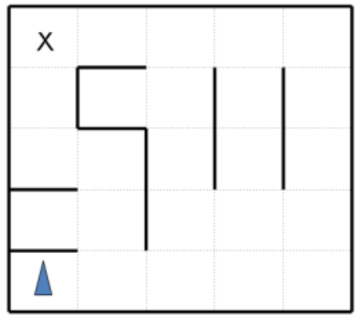

Figure 3

The agent is directional and at all times faces some direction $d \in (N, S, E, W)$. With a single action, the agent can either move forward at an adjustable velocity v or turn. The turning actions are *left* and *right*, which change the agents direction by 90 degrees. Turning is only permitted when the velocity is zero (and leaves it at zero). The moving actions are *fast* and *slow*. *Fast* increments the velocity by 1 and *slow* decrements the velocity by 1; in both cases the agent then moves a number of squares equal to its NEW adjusted velocity. Any action that would result in a collision with a wall crashes the agent and is illegal. Any action that would reduce v below 0 or above a maximum speed V_max is also illegal. The agents goal is to find a plan which parks it (stationary) on the exit square using as few actions (time steps) as possible.

As an example: if the agent shown were initially stationary, it might first turn to the east using (*right*), then move one square east using *fast*, then two more squares east using *fast* again. The agent will of course have to *slow* to turn.

1.a If the grid is M by N , what is the size of the state space? Justify your answer. You should assume that all configurations are reachable from the start state.

1.b What is the maximum branching factor of this problem? You may assume that illegal actions are simply not returned by the successor function. Briefly justify your answer.

1.c Is the Manhattan distance from the agents location to the exits location admissible? Why or why not?

1.d State and justify a non-trivial admissible heuristic for this problem which is not the Manhattan distance to the exit.

1.e If we used an inadmissible heuristic in A* tree search, could it change the completeness of the search?

1.f If we used an inadmissible heuristic in A* tree search, could it change the optimality of the search?

1.g Give a general advantage that an inadmissible heuristic might have over an admissible one.