COMPSCI 383 – Spring 2021

Homework 1 Primer

Due Monday, February 15th at 11:59pm ET

You are encouraged to discuss the assignment in general with your classmates, and may optionally collaborate with one other student. If you choose to do so, you must indicate with whom you worked. Multiple teams (or non-partnered students) submitting the same solutions will be considered plagiarism.

Understanding Search Basics

This assignment is intended to help you build some intuition for how different search strategies work, what their strengths and weaknesses are, and what types of things we can or cannot guarantee about their behavior.

Grading

We will grade your answers based on whether they demonstrate an understanding of the concepts in each question. Some questions have more than one correct answer. We will award partial credit for answers that show partial understanding.

What to Submit

You should submit a file named `homework1primer.pdf`, containing your answers to the questions. You can record your answers on this document (preferred) or create your own.

Questions

1. What guarantees, if any, does Breadth-first search make, assuming a finite search graph? Under what conditions do these guarantees hold?

2. If at every state there are b successors, and the goal state is at depth d, what is the upper limit of the number of states Breadth-first search needs to add to its frontier?

3. Uniform-cost search is optimal, but Greedy best-first search is not. Given that both have exponential time complexity, why would you ever use Greedy?

4. What guarantees, if any, does A* search make, assuming a finite search graph and a heuristic that is both admissible and consistent?

5. Which property or properties of A* is/are violated if the heuristic used is not admissible consistent?

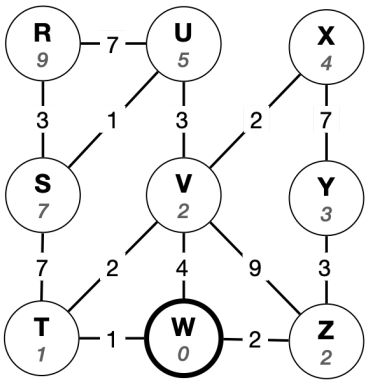
6. Why is h(s) = 0 for all states s always an admissible heuristic?

7. If h(s) = 0 for all states s, is there another search strategy that will behave the same as A*? If so, which one? And why?

8. Given two admissible heuristics, h1(s) and h2(s), if h1(s) > h2(s) for all s, which heuristic is better? Why?

9. Explain why storing the frontier in a linked list is a bad idea for any best-first search (Uniform-cost, Greedy best-first, A*).

10. The graph on the right represents a state space with states (nodes) **R-Z**. Possible transitions between states are represented by the edges in the graph, and numbers along the edges show the cost of each transition. The numbers inside the circles indicate the value of an admissible and consistent heuristic function that estimates the path cost to state W.



Consider a (graph-based) search with start state **R** and goal state **W.** Show your work. For each of the following search strategies, show the order that the states will be popped from the frontier data structure, along with the solution path that will be returned.

a. Breadth-first search

b. Uniform-cost search

c. Greedy best-first search

d. A* search