CS 411: Artificial Intelligence I
Written Homework 1
Due Sunday of Week 2 11:59 PM

You may discuss the assignment with other students, but if you do you must note on your submission who you discussed it with. The actual submission must be entirely your own work. It must be submitted via gradescope. Please make sure to tag which page(s) each problem is answered on at the appropriate step in the submission process.

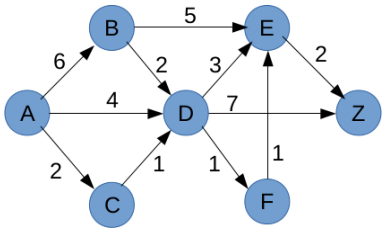

Figure 1: Search cost graph.

1. **Search tree** Draw the complete search tree for this graph starting from A. Please list children in the tree in alphabetical order from left to right.
2. **Breadth first tree search.** Indicate which nodes of the search tree will be expanded using breadth first tree search from A to Z.
3. **Reverse search tree** Sometimes searching backward can be more efficient. Reverse the direction of the edges of the search cost graph and show the resulting search tree from Z to A.
4. **Reverse uniform cost tree search** Indicate which nodes of the reverse search tree will be expanded using uniform cost tree search from Z to A.
5. **Bidirectional uniform cost tree search.** Another useful trick is to search forward (A to Z) and backward (Z to A) simultaneously until a node is expanded by one search while some other path to that node is in the fringe of the other search. This idea can be implemented by using a single UCS priority queue and starting with the root node for each search tree enqueued. Show the portions of the forward and backward search trees that are explored to find this common node.
6. **Iterative Deepening Search** Prove that if there is a solution at depth d and the branching factor of the search tree is b then iterative deepening search expands $O(b^d)$ nodes

Grading standards:

- Full Credit (1.0) - All questions attempted, most with minor or no errors
- Partial Credit (0.5) - A number of questions may have significant errors
- Some Credit (0.25) - Many questions attempted with answers demonstrating some understanding of relevant concepts
- Insufficient evidence (0) - Many questions either not attempted or with answers not demonstrating understanding of relevant concepts