CSci 4511 Spring 2019

1st Midterm Exam

Thursday March 7
75 minutes – open book and notes
100 points plus 10 points extra credit

1. *25 points*
   You are given a simple scheduling problem. You have a group of m people and a set of n tasks, each with a duration. Assume that $n > m$. You want to assign tasks to people so that the time when the last task is completed is minimized.
   Answer the following questions. Explain briefly your reasoning:

   1. Describe how you would represent the state space, including the initial state, successor function, cost function, and goal test.

   2. Is the search space a tree or a graph?

Turn to the next page for more questions

2. *20 points* Suppose you are using *Uniform Cost* search.

   1. You decide to add a constant C (> 1) to the cost, $c_{i,j}$, of each link.
      Is uniform cost using your modified $c_{i,j}$ still guaranteed to find an optimal solution? Why (or why not)? Explain your reasoning.

   2. Suppose that instead you decide to multiply the cost of each link $c_{i,j}$ by a constant C (> 1). Is uniform cost using your modified $c_{i,j}$ still guaranteed to find an optimal solution? Why (or why not)? Explain your reasoning.

Turn to the next page for more questions

3. *15 points*
   Suppose you decide not to keep the explored set (i.e. the place where the explored nodes are saved) in the A* algorithm.

   1. If the heuristic used is admissible, will the new algorithm still be guaranteed to find the optimal solution? Explain why (or why not).

   2. Will the new algorithm be complete? Explain.

   3. Will the new algorithm be faster or not? Explain.

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4. *10 points*

When doing search, the search space has directed links, each corresponding to an action that goes from one state to a successor state. Suppose instead we want the search space to be an undirected graph. Answer the following questions, explaining briefly your reasoning:

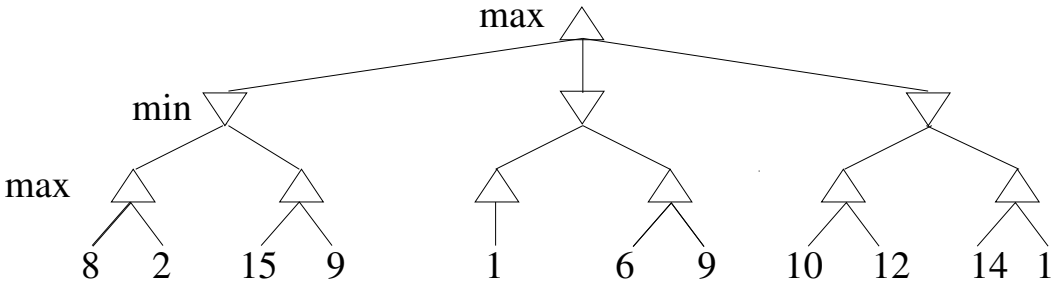
1. Would changes be required to allow the search space to be a undirected graph?

2. Would this be a good idea? Why (or why not)?

Turn to the next page for more questions

5. *15 points*

Show the backed-up values for the nodes in the following game tree and show the branches that are pruned by alpha-beta pruning. For each branch pruned, write down the condition that is used to do the pruning. Follow the convention used in the textbook to examine the branches in the tree from left to right.



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6. *15 points*
   Answer the following questions explaining your reasoning briefly but precisely.

   1. Why any heuristic which is an optimal solution to a relaxed problem is admissible and consistent?

   2. What is the difference between an incremental and a complete-state space representation?

   3. Does the complexity of minimax change depending on whether the algorithm generates the successors of a node one at a time or all at once? Explain.

Turn to the next page for more questions

7. *10 points* Extra Credit

   Inspired by the iterative deepening algorithm, you decide to design an *iterative broadening algorithm*. The idea is to start with 2 children, and do depth-first search limiting ar each node expansion the number of children to 2. If you fail to find a solution, you restart the search from the beginning increasing the number of children by 1. Repeat this process until you find a solution.

   1. What advantages do you see in this algorithm?

   2. What shortcomings do you see in this algorithm?

YOU REACHED THE END OF THE EXAM