CSci 5511 Fall 2014

1st Midterm Exam

Tuesday October 14
75 minutes == 75 points
Open book and notes

1. *20 points*
   You are organizing a dinner and have to assign seats to n guests around a round table with n places. For every pair of guests there is a positive value $Pleasure(i, j)$ that measures how much guest i likes sitting next to guest j. For simplicity assume that $Pleasure(i, j) = Pleasure(j, i)$. Your objective is to find the seat assignment that maximizes the total pleasure of your guests.

   1. Formulate the problem as a search problem by defining the space of states. Specify how you would represent the states, then specify the initial state, the goal condition, and the actions.
   2. Does your state space contain repeated nodes? If yes, specify what conditions need to be checked to prevent repeated states.
   3. Propose a non-trivial (i.e., not h(n)=0) heuristic function for the problem. Specify if your function is admissible or not.

2. *10 points*
   In A* the nodes that have been generated but not yet expanded are sorted according to the value of $f(n) = g(n) + h(n)$, i.e. the sum of the cost from the start to node n plus the estimated cost from n to goal using an admissible heuristic $h(.)$. Nodes that have the same $f(.)$ value are ordered arbitrarily.

   Can you suggest some domain independent criteria that could be used to re-order nodes with the same $f(.)$ value? Explain your answer.

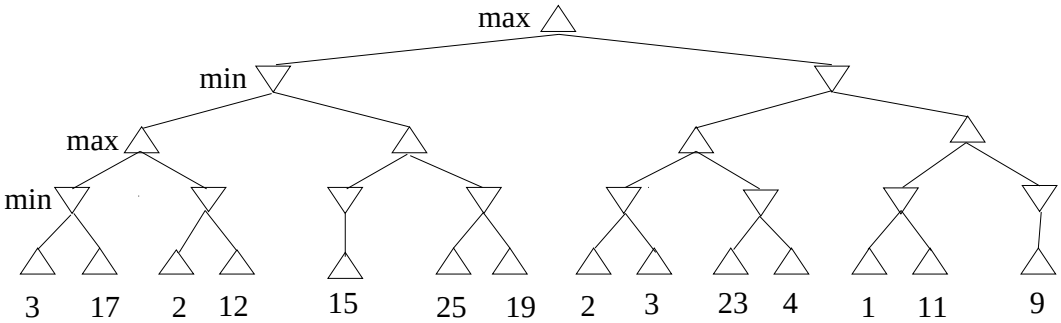
3. *10 points*
   Suppose you have two admissible heuristics, h_1 and h_2. You decide to create the following new heuristics defined as follows:

   1. $h_3(n) = max(h_1(n), h_2(n))$
   2. $h_4(n) = max(h_1(n), 1.1 * h_2(n))$
   3. $h_5(n) = min(h_1(n), 3 * h_2(n))$
   4. $h_6(n) = \frac{h_1(n)+h_2(n)}{2}$

Turn to the next page for more questions

For each of the new heuristics specify if it is admissible or not. Justify your answer. Would you use any of these heuristics instead of using h_1 or h_2? Why?

4. *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.



5. *20 points*
Answer these questions briefly but precisely.

   1. Can you make A* behave like Breadth-First Search? If yes, how? If not, why not? Be precise and specify what you will use for $g(n)$ and for $h(n)$.
   2. Why can't A* be used for on-line search?
   3. How can hill climbing be prevented from wandering forever when it reaches a plateau?
   4. How would simulated annealing work if the temperature T is always fixed at 0?
   5. What is the role of the fitness function used in genetic algorithms? Could the algorithm be used without a fitness function?

YOU REACHED THE END OF THE EXAM