

CSCI/PHIL 4550/6550 Artificial Intelligence

Problem Set Number 2: Due 9/20/2007 (in class)

1. [10 points] Solve problem 4.1 page 134 in Russell and Norvig.
2. [10 points] Solve problem 4.2 page 134 in Russell and Norvig.
3. [20 points] Suppose you have just solved a state space search problem using the A* algorithm with a heuristic function $h(n)$ and found a solution that you thought was optimal with cost $f_{apparent}^*$. Suppose you then discovered that the heuristic function you had used ($h(n)$) was not admissible, but rather it was ϵ – *admissible* meaning that it could over estimate the cost of getting to the nearest goal state by at most ϵ .
 - (a) What is the relation between the cost of the solution you found $f_{apparent}^*$ to the true optimal solution cost f^* ? Briefly justify your answer.
 - (b) How would you modify the A* algorithm to be able to use an ϵ – *admissible* heuristic function and still find the true optimal solution in the most efficient way?
4. [10 points] Solve problem 5.6 page 159 in Russell and Norvig.
5. [20 points] **Sorting** The sorting problem is stated as follows. Given a set of n real numbers $X = x_1, x_2, \dots, x_n$. Find a permutation (reordering) $P = p_1, p_2, \dots, p_n$ of the set X such that $p_1 \leq p_2 \leq \dots \leq p_n$.
 - (a) Formulate the sorting problem as a Constraint Satisfaction Problem (CSP): you should include an informal description of the following:
 - The set of variables.
 - The domain of values for each variable.
 - The collection of constraints on the variables.
 - For each constraint, an indication the *arity* of the constraint: (unary, binary, n-ary or global).
 - Hint:** you may assume that the elements of the set X are unique.
 - (b) Solve the CSP you have formulated for the case $X = 5, 3, 7, 1, 9$. Show the solution tree using backtracking with forward checking.
6. **For CSCI/PHIL 6550 students only** [10 points] Solve problem 4.7 page 135 in Russell and Norvig.