

Artificial Intelligence - Assignment 1

Posted Friday, September 12, 2003, 10:30pm

Due Tuesday, September 23, 2003, in class

1. [10 points]

Uninformed search This problem is based on Problem 3.8., pg. 90 from Russell & Norvig. Consider a state space where the start state is number 1 and the successor function for state n returns two states, numbers $2n$ and $2n + 1$.

(a) [2 points] Draw the portion of the state space for states 1 through 15

(b) [8 points] Suppose the goal state is 11. List the order in which the nodes will be expanded for breadth-first search, depth-limited search with limit 3, and iterative deepening search. Recall that a node is expanded if it is removed from the search queue, checked for “goalness”, and its children are inserted in the queue.

2. [15 points] **Uninformed/informed search** Russell & Norvig, pg. 91, Problem 3.11., items a, b, c.

3. [10 points] **Informed search** Russell & Norvig, pg. 134, Problem 4.2

4. [20 points] **Heuristics** Assume that we have two admissible heuristics, h_1 and h_2 , for a given problem. Which of the following combinations will also be admissible? Justify your answer.

(a) $h_1 + h_2$

(b) $\frac{h_1+h_2}{2}$

(c) $|h_1 - h_2|$

(d) $h_1 h_2$

(e) $2h_1$

(f) $0.5h_1$

(g) $\min(h_1, h_2)$

(h) $\max(h_1, h_2)$

(i) $h_1 + 2h_2$

(j) $\min(h_1, 2h_2)$

Comment on how tight these heuristics are compared to the initial ones.

5. [20 points] **Genetic algorithms** Suppose you want to apply a genetic algorithm in order to construct a chess player.

- (a) What is the fitness function?
 - (b) How would you represent the player?
 - (c) What kind of crossover and mutation operators would you apply?
6. [15 points] **Search/constraint satisfaction** Russell & Norvig, pg. 158, Problem 5.4.
7. [10 points] **Constraint satisfaction** Russell & Norvig, pg. 159, Problem 5.13.