

CS472 Foundations of Artificial Intelligence

Fall 2004

Assignment 1

Due Monday, September 13, 2004 by the beginning of class.

Submit through CMS.

1. Loebner Competition (15 pts.)

We talked about the Loebner Competition in the first class of the semester. For this problem, you should research and write a very brief (one page) report on the latest winner of the Loebner prize. Briefly state what system won the prize and what it did. Spend the rest of the page critiquing the system. Some of the questions to consider include: Can you determine what techniques the system used? Does it advance the state of the art in AI? What were the strong/weak points of the system? Please be sure to write objectively and to include supporting arguments for each of your key points.

Use 11pt font and single-spacing for the 1-page document.

2. Formulating Search Problems (30 pts.)

Give the initial state, goal test, successor function, and cost function for each of the following. Choose a formulation that is precise enough to be implemented.

- a) As some sort of “joke”, your roommate placed your last bottle of red bull at the very top of your highest bookshelf. Having somehow missed out on the tall genes in your family, you are not able to reach the bottle without a little help from your dorm room furniture. The only things not nailed to the floor are your mini fridge and a papasan chair. You are thirsty and want to get your bottle down.

The height of the mini fridge is 1 foot, the papasan 2 feet, and the book shelf 9 feet. You are only 5 feet tall but can reach to 6 feet. You are at your door, and your items are not yet stacked on one another.

- b) Most of you who have been on a road trip have probably played the following 2-player game. You start with a set X of actors. The first player names an actor $x_1 \in X$, and the other player names an actor $x_2 \in X \setminus \{x_1\}$ who has appeared in a movie with x_1 . The

first player must then name an actor x_3 who has appeared in a movie with x_2 , and so on. So the two players generate a sequence of actors such that each actor in the sequence has co-starred with the actor immediately preceding. A player loses when it's his turn to move, and he cannot name an actor of X who hasn't been named before.

You are given a set of actors X , with complete information on who has appeared in a movie with whom, and you want to determine how to win the game.

- c) Suppose for a moment that you have decided to use your Cornell education to become a bank robber. In any bank, the items of interest have a variety of values and weights, and at your disposal is a police-provided helicopter waiting to whisk you and your booty away to some undisclosed tropical hideaway. Ideally you would just take everything possible from the bank. Unfortunately, the helicopter has a weight limit that you, as a conscientious bank robber, do not want to surpass.

Each item i has weight w_i and value v_i , and the helicopter has weight limit W . You want to select a maximum value subset of items subject to the constraint that their total weight cannot surpass W .

3. Space Requirements (15 pts.) Consider the n -queens problem using the “efficient” incremental formulation given on page 67 (of R&N, second edition). Explain why the state space size is at least $\sqrt[3]{n!}$.

4. Search Algorithms (10 pts.) Consider the following search algorithm:

- i. Set the breadth cutoff, c , to 2.
- ii. Set L to be the set of initial node(s), i.e. nodes associated with the initial state(s).
- iii. Let n be the first node in L . If L is empty, increment c and return to step ii.
- iv. If n is a goal node, stop and return it (and the path from the initial node to n).
- v. Otherwise, remove n from L . Add to the front of L the first c of n 's children (labeling each with its path from the initial node). Return to step iii.

Describe a specific search problem for which this search algorithm is likely to be a better solution than iterative deepening. Be sure to explain your answer.

5. Paper Critique (20 pts.) Read the following paper and write a short critique concerning its main issues. The purpose of a critique is to discuss the merit of 2 or 3 points from the paper; question the results, the assumptions, the applications, etc.. There are helpful guidelines for critiques on the course web site, as well as samples to give you an idea of what we're looking for. We strongly recommend you take a look at these. And remember, your critique should be *at most* one page long (11pt font and single-spacing), and should not just be a summary of the paper!

Greg A. Keim, Noam Shazeer, Michael L. Littman, Sushant Agarwal, Catherine M. Cheves, Joseph Fitzgerald, Jason Grosland, Fan Jiang, Shannon Pollard, and Karl Weinmeister. Proverb: The probabilistic cruciverbalist. In Proceedings of the Sixteenth National Conference on Artificial Intelligence, pages 710-717, 1999.

A postscript version can be found at

<http://www.cs.duke.edu/mlittman/papers/aaai99-crossword.ps>

What to Turn In:

Submit to CMS a zip archive containing five files, one for each of the above problems.