CS 441/541
Artificial Intelligence
Fall, 2006

Homework 3: Search and Game Playing

Due Tuesday, October 17.

1. Is minimax a depth-first or breadth-first search procedure? Explain your answer.

2. Textbook problem 6.1

3. The game of Nim (also called Tactix) is played by the following rules: Staring with one or more piles (heaps) of one or more pieces each, players alternate by taking all or some of the pieces in a single heap. The player taking the last piece or stack of pieces is the winner.

For example, the picture below illustrates a starting position with four heaps, with one, three, five, and seven pieces respectively. Players alternate in removing a number of pieces from a chosen heap. The number of pieces chosen to remove must be greater than zero, and less than or equal to the number of pieces in the heap.

(a). Give a heuristic that assigns a value to a given position (configuration of heaps) in Nim.

(b). Repeat steps (b)–(e) of problem 6.1, but for Nim instead of tic-tac-toe, using your heuristic, with a starting position of three heaps with one, three, and five pieces respectively.

(c). For the three-heap starting position of one, three, and five pieces, which player (first or second) has a certain winning strategy? Why?

4. Textbook problem 6.2

5. Prove that the time complexity of *expectminimax* is $O(b^m n^m)$, as described in the textbook on p. 178.