CISC 3410 Fall 2010, Homework 3

1. For each of the following activities, say (with justification), whether or not they require intelligence:

   (a) cracking an egg into a bowl to make an omlette;

   (b) riding a bicycle;

   (c) solving differential equations;

   (d) writing a computer program;

   (e) playing table tennis.

   (10 points)

2. Classify each of the environments in which each of the following agents operates:

   (a) a robot that delivers mail around the office;

   (b) a program that sorts my mail, based on things like subject line and sender.

   (c) a program that manages my apartment: maintaining the temperature by opening and closing windows and turning the heat on and off; checking whether the cats have enough food and water, and dispensing more if required; and monitoring the food in the fridge, ordering more to be delivered if necessary.

   as

   - Accessible *vs* inaccessible
   - Deterministic *vs* non-deterministic
   - Episodic *vs* non-episodic
   - Static *vs* dynamic
   - Discrete *vs* continuous

   As part of your answer, you should explain *why* you classify each environment in the way you do.

   (20 points)

3. The *Towers of Hanoi* problem:

   > "In a Tibetan monastry, there are 3 columns and 64 golden rings. The rings are of different sizes and rest over the columns. At the beginning of time, all the rings rested on the leftmost column, and since then, the monks have been moving the rings 1-by-1 between columns. The monks must obey two rules:
   >
   > (a) They may only move one ring at a time between columns.
   >
   > (b) No ring may rest upon a smaller ring."

   The 64 ring Hanoi problem is hard (and very very slow to solve). We will consider a small version of the problem using 3 rings (see Figure 1).

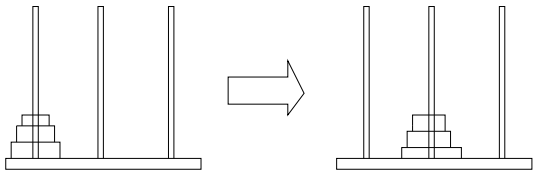

Figure 1: The 3 Ring Towers of Hanoi Problem

Write down the search tree for the 3-ring problem using:

(a) depth limited search to depth 3;

(b) iterative deepening to depth 4;

Next, formulate a path cost function and an admissible heuristic for the problem, and solve it using:

(c) uniform cost search;

(d) greedy search;

(e) A* search.

(40 points)

4. Consider the game tree in Figure 2 (overleaf). Nodes represent states of a game. The numbers in the nodes are the names of the nodes. Numbers next to the nodes, if any, are the values of the nodes, reflecting the values of the corresponding states of the game.

   (a) Apply minimax search to the game tree to compute the values of the triangular nodes.

   (b) Which nodes should be pruned using the alpha/beta technique. Your answer should explain why each node that you list should be pruned.

   (30 points)

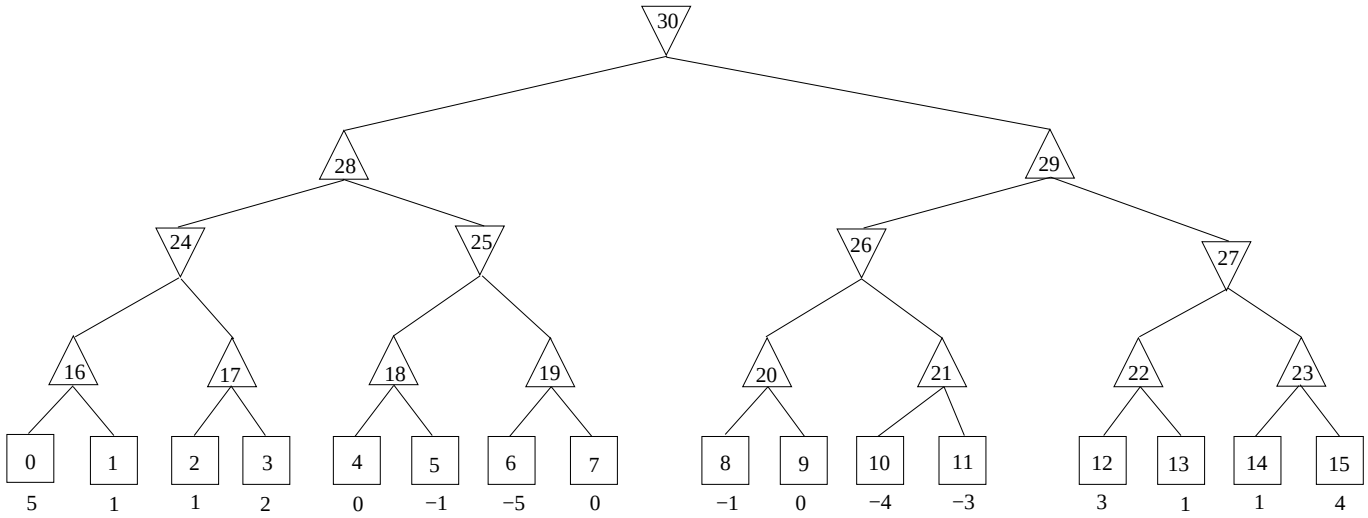

Figure 2: The game tree for Question 4.