Homework 4

Assigned on: Monday September 24th, 2018.

Due: Monday, October 1st, 2018.
Except for the programming questions (i.e., Exercices 1 and 7), which must be submitted with `webhandin` as probem#.lisp, you may turn in your homework on paper or type it and submit it to `webhandin`.

Value: 90 points for ugrads and 95 points for grads.

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1   Implementing a simple-reflex agent.   Total: 20 points

- Write in Common Lisp a function that 'models' the simple-reflex agent for the vacuum-cleaner problem in an environment with two locations, as summarized on page 5 of the Intructor's notes #4. The function should take as input the percepts of the agent as location of the agent and status of the room.

- Write a Common Lisp function that takes any of the 8 possible states of the vacuum-cleamer of Figure 3.3 of AIMA and runs the simple-reflect agent until the goal is reached.

- Design a performance measure that penalizes the agent for each step and each suck action. Record the agent performance for each one of the above 8 possible states.

2   AIMA, Exercise 3.6, Page 113.   Total 10/15 points

- a: for ugrads and grads.   5 points

- b: for ugrads and grads.   5 points

- d: grads (bonus for ugrads).   5 points

3   AIMA, Exercise 3.15, Page 116.   Total: 10 points

4   Evaluation function.   Total: 6 points

Adapted from AIMA, Edition 1.

With $g(n)$ being the path length,
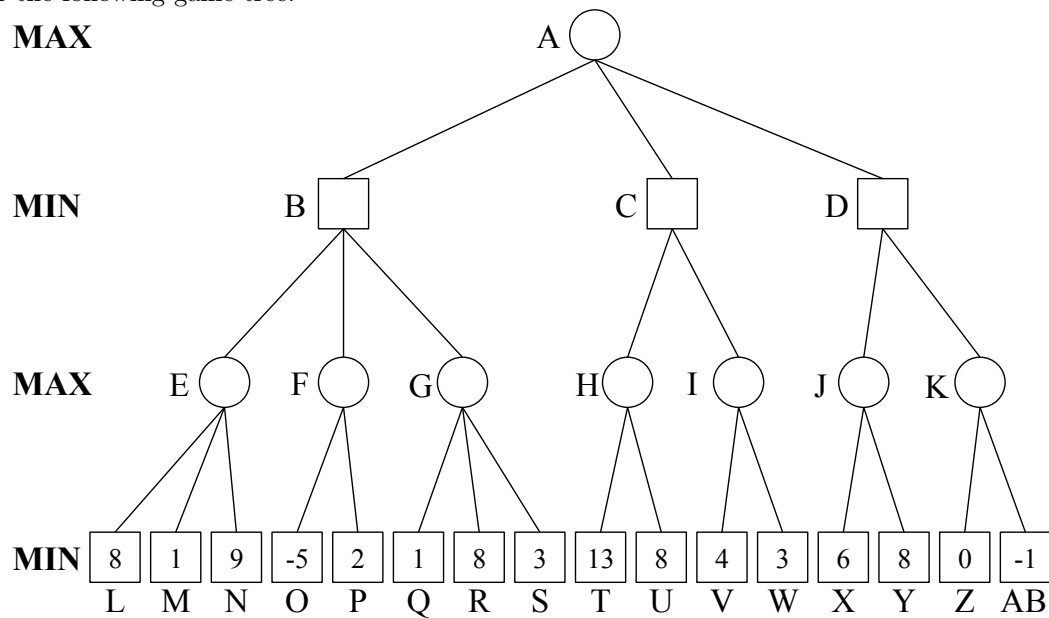
1. Suppose that we run a greedy search algorithm with $h(n) = -g(n)$. What sort of search will the greedy search emulate?
   Explain.   3 points

2. Suppose that we run a search algorithm with $h(n) = g(n)$. What sort of search will the greedy search emulate?
   Explain.   3 points

5 AIMA, Exercise 3.21, Page 117. Total: 9 points

6 AIMA, Exercise 3.23, Page 118. Total: 10 points

7 AIMA, Exercise 3.30, Page 119. Total: 15 points

- Question a — 10 points
- Question b — 5 points
- Question c: Optional challenge — 15 bonus points
- Question d: Optional challenge — 30 bonus points

8   Adverserial Search   5 points

Consider the following game tree:

MAX   A ◯

MIN   B ☐   C ☐   D ☐

MAX   E ◯   F ◯   G ◯   H ◯   I ◯   J ◯   K ◯

MIN | 8 | 1 | 9 | -5 | 2 | 1 | 8 | 3 | 13 | 8 | 4 | 3 | 6 | 8 | 0 | -1 |
         | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z | AB |

1. Compute the minimax decision. Show your answer by writing the values at the appropriate nodes in the above tree. **4 points**

2. What move should Max choose? **1 point**

9   Alpha-beta Pruning   5 points

Using the *alpha-beta pruning method*, with standard left-to-right evaluation of nodes, show what nodes are *not* examined by alpha-beta.