Homework 1 – Artificial Intelligence

Teacher: Stefán Ólafsson

January 10, 2023

Time Estimate

3 hours including reading through the relevant parts of chapters 2 and 3 in the book, assuming you have been to the lecture (or watched the recording).

Instructions

Hand in a PDF file with the answers to the questions in Canvas. This assignment is to be done individually.

Questions

1. (15 points) Define the following terms in your own words:

1.1 (5 points) Agent

1.2 (5 points) Agent function

1.3 (5 points) Rational agent

2. (20 points) Consider the task of a robot playing a game of football (soccer) in a team with humans.

2.1 (8 points) Give a PEAS description of this task environment (Agents, slides 11/12).

2.2 (12 points) Characterize the environment in terms of the properties (Agents, slide 13 / book, page 42-44):

- fully vs. partially observable
- deterministic vs. stochastic
- episodic vs. sequential
- static vs. dynamic
- discrete vs. continuous
- single vs. multi-agent

If you are unsure about an answer, give a short explanation. Several solutions are possible, depending on the level of abstraction you choose.

3. (65 points) Consider the following problem: *Three cannibals and three missionaries must cross a river. Their boat can only hold two people. The cannibals must never outnumber the missionaries on either side of the river. Every person, whether missionary or cannibal, can row the boat.*

3.1 (30 points) Give a complete formulation of the problem as a search problem. Make the formulation precise enough to be implementable. For example, you could write down data structures for states and actions and pseudo code for other components of a search problem.

3.2 (20 points) Give plausible estimates for

- average branching factor
- depth of shortest solution
- size of the state space
- size of the search tree (expanded as deep as the shortest solution)

and shortly explain how you got to those estimates.

3.3 (15 points) What could explain that the state space and search tree have different sizes?

3.4 **(10 bonus points)** What is the actual size of the state space (number of reachable states)? Compare it to your estimate and explain the difference! (Hint: You can draw the graph of all states and count them. It should be small enough for you to do this.)