

Homework 2 – Artificial Intelligence

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January 20, 2023

Time Estimate

3 hours including reading the relevant parts of chapter 3 (up to and including 3.6), assuming you have been to the lectures (or watched the recordings).

Instructions

Hand in a PDF file with the answers to all questions on Canvas.

Questions

1. (60 points) Consider a generalized version of the cannibals and missionaries problem: C cannibals and M missionaries must cross a river. Their boat can only hold B people ($B \geq 2$). The cannibals must never outnumber the missionaries on either side of the river or on the boat. Every person, whether missionary or cannibal, can row the boat. How can they all get over the river with the fewest number of trips?
 - (a) (10 points) Give a complete formulation of the problem as a search problem. Think of what information is needed for a state of the problem and what the possible actions are. 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.
 - (b) (20 points) For the general case with M missionaries and C cannibals and boat capacity B , 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)(the estimates may depend on M , C and B) and shortly explain how you got to those estimates. What numbers do you get for the special case of $M=C=3$ and $B=2$? Does that match your estimates from hw1?
 - (c) (30 points) Discuss which of the the search algorithms we discussed in class can be used to solve the problem and under which conditions. Which one would you choose and why?
2. (40 points)

- (a) (20 points) Explain the terms “admissible heuristics” and “consistent heuristics” in your own words.
- (b) (10 points) When do you need an admissible heuristics and when a consistent heuristics?
- (c) (10 points) In general, how can you construct an admissible heuristics for any given problem?