

AERO 552: Aerospace Information Systems

Homework 5

Out Saturday, November 5th, 2023

Due on CANVAS Monday, November 13th, 2023, **11:59pm**
You may only use up to one late day on this homework

Instructions

Your solution should be submitted as a file `hw5.pdf` containing your solution to the handwritten problems;

High-level discussion of problems and directions with other students is fine, but exchanging solutions or code is not. If in doubt, please ask. **If you discussed with another student, please indicate so explicitly in your homework, with their name.**

Exercise 1 – Search (30 points)

Give the initial state, goal test, successor function, and cost function for each of the following. Choose a formulation that is precise enough to be implemented. (Exercise 3.6 p. 113 in `search_astar.pdf`)

1. You have to color a planar map using only four colors, in such a way that no two adjacent regions have the same color.
2. A 3-foot-tall monkey is in a room where some bananas are suspended from the 8-foot ceiling. He would like to get the bananas. The room contains two stackable, movable, climbable 3-foot-high crates.
3. You have a program that outputs the message “illegal input record” when fed a certain file of input records. You know that processing of each record is independent of the other records. You want to discover what record is illegal.
4. You have three jugs, measuring 12 gallons, 8 gallons, and 3 gallons, and a water faucet. You can fill the jugs up or empty them out from one to another or onto the ground. You need to measure out exactly one gallon.

Exercise 2 – Uninformed Search (30 points)

Consider a state space where the start state is number 1 and the successor function for state n returns two states, numbers $2n$ and $2n + 1$.

1. Draw the portion of the state space for states 1 to 15.
2. Suppose the goal state is 11. List the order in which nodes will be visited for breadth-first search, depth-limited search with limit 3, and iterative deepening search.
3. Would bidirectional search be appropriate for this problem? If so, describe in detail how it would work.
4. What is the branching factor in each direction of the bidirectional search?

5. Does the answer to (3) suggest a reformulation of the problem that would allow you to solve the problem of getting from state 1 to a given goal state with almost no search?

Exercise 3 – Missionaries and Cannibals (35 points)

Exercise 3.9 page 115 in the lecture notes (`search_astar.pdf`), including the implementation.

Bookkeeping (5 points)

Indicate in a sentence or two:

1. how much time you spent on this homework;
2. how difficult you found it subjectively;
3. what you found to be the hardest part;
4. how deeply you feel you understand the material it covers (0%–100%).