

Problem-solving as search: Exercises

Due: Monday Oct. 1

Turn in either neatly written or computer formatted answers.

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

(a) Draw the portion of the state space for states 1 to 15.

(b) 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 (to level 3).

(c) Would bidirectional search be appropriate for this problem? If so, describe how it would work (i.e., explain successor function for backwards search).

(d) Does the answer to (c) 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?

2. Consider the “Missionaries and Cannibals” problem:

Three missionaries and three cannibals come to the north bank of a river. A rowboat is on the same bank of the river as the missionaries and cannibals but it is small, so only one or two people can use it to cross the river at one time. If the cannibals ever outnumber the missionaries on either bank of the river, the missionaries will be eaten. How can they all cross the river to the south bank, using the rowboat, without anyone being eaten?

The allowable moves are:

(1) If boat is on north bank, either one or two people row the boat from the north to the south bank.

(2) If boat is on south bank, either one or two people row the boat from the south to the north bank.

Moves that leave cannibals outnumbering missionaries on either bank are not allowed.

(a) Explain how you would represent states for this problem. Give the initial state of the problem in this representation. (Note that there are many possible correct answers here; you just need to give one.)

(b) Give a possible heuristic h for evaluating a given state s .

(c) Draw a search tree with two levels: the initial state and the successors to the initial state. Evaluate each successor state with your heuristic, and give the one that would be chosen by greedy best-first search to expand next.