
Missionaries and Cannibals State Space Problem Solver

State Space Problem Solving Model for the Missionaries and Cannibals Problem

1. PROBLEM STATEMENT

Three missionaries and three cannibals, along with one boat that fits at most two people (and requires at least one person for operation), are on the left bank of the river. The most salient thing about missionaries and cannibals in “cohabitation” is that if ever the cannibals in any one spot (left bank, right bank, on the boat) outnumber the missionaries, the outnumbered missionaries will be consumed – eaten! The goal of this problem is to get all six individuals safely across the river from the left bank to the right bank.

2. THE OBJECTS OF THE STATE SPACE WORLD

- i. 3 missionaries
- ii. 3 cannibals
- iii. left bank
- iv. right bank
- v. boat

3. REPRESENTATION OF A STATE OF THE WORLD

We will represent a state as where $0 \leq M \leq 3$ and $0 \leq C \leq 3$. M represents the number of missionaries on a bank and C represents the number of cannibals on a bank. B represents which bank the boat is at, so $B = L$ or $B = R$. As a whole, it represents the situation on each bank. Eg. : means there are 3 missionaries and 3 cannibals on the left bank.

4. THE STATE SPACE DESCRIPTION

- i. Initial state set: $\{ \langle (3,3) L \rangle \langle (0,0) R \rangle \}$
- ii. Goal state set: $\{ \langle (3,3) R \rangle \langle (0,0) L \rangle \}$
- iii. 1 missionary crosses left bank to right bank O1: $\langle (M-1,C) L \rangle \langle (M+1,C) R \rangle$
- iv. 1 cannibal crosses left bank to right bank O2: $\langle (M,C-1) L \rangle \langle (M,C+1) R \rangle$
- v. 1 missionary crosses right bank to left bank O3: $\langle (M-1,C) R \rangle \langle (M+1,C) L \rangle$
- vi. 1 cannibal crosses right bank to left bank O4: $\langle (M,C-1) R \rangle \langle (M,C+1) L \rangle$
- vii. 2 missionaries cross left bank to right bank O5: $\langle (M-2,C) L \rangle \langle (M+2,C) R \rangle$
- viii. 2 cannibals cross left bank to right bank O6: $\langle (M,C-2) L \rangle \langle (M,C+2) R \rangle$
- ix. 2 missionaries cross right bank to left bank O7: $\langle (M-2,C) R \rangle \langle (M+2,C) L \rangle$
- x. 2 cannibals cross right bank to left bank O8: $\langle (M,C-2) R \rangle \langle (M,C+2) L \rangle$
- xi. 1 missionary and 1 cannibal cross left bank to right bank O9: $\langle (M-1,C-1) L \rangle \langle (M+1,C+1) R \rangle$
- xii. 1 missionary and 1 cannibal cross right bank to left bank O10: $\langle (M-1,C-1) R \rangle \langle (M+1,C+1) L \rangle$

6. STATE SPACE SOLUTION

- i. $\langle O6, O4, O6, O4, O5, O10, O5, O4, O6, O4, O6 \rangle$

