

Modelling Challenge: Missionaries and Cannibals

State Space Problem Solver

Problem Statement: Three missionaries and three cannibals, along with one boat that fits at most two people (and requires at least one for operation), are on the left bank of a 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.

The Objects of the State Space World: 3 missionaries, 3 cannibals, 1 boat, a left river bank, and a right river bank.

Representation of a State of the World: A state of the world is represented as two lists, one of these lists representing the left bank and one representing the right bank. These lists may contain some number of characters M (missionary) C (cannibal) or B (boat). The initial condition would be represented as { (M M M C C C B) () }.

The State Space Description: Initial States: { (M M M C C C B) () } ; Goal States: { () (M M M C C C B) } ; State Space Operators: (X X B) or (X B) such that X is either M or C, this operator will move the boat (B) along with either one or two X's from the current side that the boat is on to the other.

State Space Graph (Including At Least One Solution):

I have only shown the path to a solution because the set of possible moves grows quickly.

```
<M M M C C C B> <>
|
( C C B )
|
V
< M M M C > < C C B >
|
( C B )
|
V

< M M M C C B > < C >
|
( C C B )
|
V
< M M M > < C C C B >
|
( C B )
|
V
< M M M C B > < C C >
|
( M M B )
|
V
```

```

< M C > < M M C B >
|
( M C B )
|
V
< M M C C B > < M C B >
|
( M M B )
|
V
< C C > < M M M C B >
|
( C B )
|
V
< C C C B > < M M M >
|
( C C B )
|
V
< C > < M M M C C B >
|
( C B )
|
V
< C C B > < M M M C >
|
( C C B )
|
V
< > < M M M C C C B >

```

State Space Solution: <(C C B)(C B)(C C B)(C B)(M M B)(M C B)(M M B)(C B)(C C B)(C B)(C C B)>