Solution for Missionaries and Cannibals Problem using Search Algorithms

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Abstract

0.1 Introduction

Many transportation scheduling problems are problems of reasoning about actions. Such problems can be formulated as follows. Given a set of space points, an initial distribution of objects in these points and transportation facilities with given capacities; find an optimal sequence of transportations between the space points such that a terminal distribution of objects in these points can be attained without violating a set of given constraints on possible intermediate distribution of objects.

In a more generalized version of this problem, there are N missionaries and N cannibals (where $N \geq 3$) and the boat has a capacity k (where $k \geq 2$). We call this problem the Missionaries and Cannibals Problem.

0.2 Problem Formulation

We shall formulate now the Missionaries and Cannibals problem in a system of productions of the type described in section 2. We start by specifying a simple but straightforward N-state language.

The universe U_0 of the N-state language contains the following basic elements:

– N individuals $m_1, m_2, \ldots, m_N$ that are missionaries and N individuals $c_1, c_2, \ldots, c_N$ that are cannibals,

– an object (transportation facility) – tho boat b_k with a carrying capacity k,

– two space points p_L, p_R for the left bank and the right bank of the river respectively.

The basic relations between basic elements in U_0 are as follows:

at; this associates an individual or the boat with a space point (example: at (m_1, p_L) asserts the missionary m_1 is at the left bank)

on; this indicates that an individual is aboard the boat (example: on (c_1, b_k) asserts that the cannibal c_1 is on the boat)

A set of expressions, one for each individual and one for the boat (they specify the positions of all the individuals and of the boat) provides a basic description of a situation, i.e. it characterizes an N-state. Thus, the initial N-state for the Missionaries and Cannibals problem can be written as follows:

$$s_0 = at(b_k, p_L), at(m_1, p_L), \ldots, at(m_n, p_L), at(c_1, p_L), \ldots, at(c_N, p_L)$$

The terminal N-state is attained by substituting p_R for p_L through-out.