Exercise: Converting the Infidels

Three missionaries and three infidels have to cross a river. Their boat only provides room for two passengers. The infidels are also cannibals and are quite hungry. If there are fewer missionaries than infidels on a shore, then the missionaries have a problem. Your task is to create a shedule that can be used to cross the river. The constraint is that the missionaries must not be consumed by the infidels.

You will find a frame for this program on my web page at

`http://www.ba-stuttgart.de/~stroetma/SETL2/missionare-frame.stl`

Your task is to complete this frame to a running program solving the puzzle.

1. Define a procedure `problem`(M, I) where M is the number of missionaries on the left shore and I is the number of infidels on the left shore. The procedure should return `true` if and only if there is a problem on either the left or the right shore.

   (Line 71 in `missionary-frame.stl`)

2. Define a set P of points. Every point has to describe a situation. Represent a situation as a triple $\langle M, I, B\rangle$, where M is the number of missionaries on the left shore, I is the number of infidels on the left shore and B is the number of Boats on the left shore. The set P shall contain only those states where there is no problem for the missionaries.

   (Line 17 in `missionary-frame.stl`)

3. Define a relation R_1 on the set P. A pair

   $$\big\langle\langle M_1, I_1, B_1\rangle, \langle M_2, I_2, B_2\rangle\big\rangle$$

   should be a member of R_1 iff the state $\langle M_1, I_1, B_1\rangle$ can be transformed into the state $\langle M_2, I_2, B_2\rangle$ by crossing the boat from the left shore to the right shore. Additionally, the missionaries should not have a problem after the crossing.

   (Line 28 in `missionary-frame.stl`)

4. In the same way, define the relation R_2 as the relation describing the crossings from the right shore to the left shore.

   (Line 43 in `missionary-frame.stl`.)

5. Define the start state and the goal state.

   (Line 61 und 63 in `missionary-frame.stl`.)

   Remark: The procedure `reachable` is already a part of the file `missionary-frame.stl`. This procedure is called in line 65. Furthermore, the file contains a number of predefined procedures that are used to output intermediary results. If your program does not work immediately, then you should better check these results.