Foundations of Artificial Intelligence

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Exercise Sheet 2

Due: Friday, May 20, 2011

Exercise 2.1 (Implementation)

(a) Solve the missionaries and cannibals problem by implementing and running a suitable search algorithm. Use the programming language of your preference but stick to the problem's representation as described in the lecture. Print out the solution found by your program.

(b) How many one-way trips across the river does your solution need? Is this the shortest solution?

(c) How many nodes of the search tree did your algorithm expand in order to find a solution?

Exercise 2.2 (Search Spaces)

(a) Formalize the search space for the *alien tiles* puzzle (for its description, see `http://www.alientiles.com`). Use the formalization of the missionaries and cannibals problem which was presented in the lecture as a guideline.

(b) Specify the total runtime and memory requirement of a *breadth-first search* for search depths 1–15 in the search space defined in part (a). Assume a memory requirement of 64 bytes and a search duration of 1 μs per node.

(c) Specify the total runtime and memory requirement of an *iterative deepening search* for search depths 1–15 in the search space defined in part (a). Assume a memory requirement of 64 bytes and a search duration of 1 μs per search node.

Exercise 2.3 (Search Spaces: Avoiding Asymmetries)

In many search spaces, one can reduce the runtime by avoiding *symmetric* subsolutions.

(a) Every permutation of a move sequence in the *alien tiles* puzzle results in the same state. Why?

(b) Describe how one can modify a possibly depth-limited depth-first search algorithm so that it considers only *one* of a move sequence's many possible permutations.

(c) How does this optimization change the answer to Exercise 2.1(c)?

Note: The next exercise session is on **Tuesday, May 24**. Group 1 will meet in room 101 / 00-026, group 2 in room 82 / 00-028 (computer pool).

The exercise sheets may and should be handed in and be worked on in groups of three (3) students. Please fill the cover sheet[1] and attach it to your solution.

[1] `http://ais.informatik.uni-freiburg.de/teaching/ss11/ki/cover-sheet.pdf`