

## Foundations of Artificial Intelligence

Prof. Dr. B. Nebel, Prof. Dr. M. Riedmiller  
S. Lange, J. Witkowski, D. Zhang  
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University of Freiburg  
Department of Computer Science

### Exercise Sheet 2

**Due: Tuesday, May 11, 2010**

#### Exercise 2.1 (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  $\mu$ s per search 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  $\mu$ s per search node.

#### Exercise 2.2 (Search Spaces: Avoiding Asymmetries)

In many search spaces, one can reduce the runtime by avoiding *symmetric* sub-solutions.

- (a) Prove the following: every permutation of a move sequence in the *alien tiles* puzzle results in the same state.
- (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) (*optional, no points*): how does this optimization change the answer to Exercise 2.1(c)?

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

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<sup>1</sup><http://www.informatik.uni-freiburg.de/~ki/teaching/ss10/gki/coverSheet-english.pdf>