



3rd Theoretical Assignment in Artificial Intelligence (WS 2006/2007)

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Note: You need not hand these exercises in, and they are not graded. But bring along your solutions to the tutorial. Impress your tutors by presenting your favourite exercise to the class.

Exercise 3.1

Marvin Minsky claims to stem from Charles the Great. Which way is easier to check the claim: to show that Charles the Great is an ancestor of Minsky or to show that Minsky is a descendant of Charles the Great? Explain.

Exercise 3.2

Consider the problem that you have 3 pegs, A B and C, and a number N of discs, all with different diameters. A larger disc cannot be placed on top of a smaller disc. The discs are initially placed on peg A, and the goal is to move them all on peg C, in a minimal number of moves.

1. Formulate this as a search problem. Specify the representation of the states (parameterized over N), operators, goal, start state and cost function.
2. What is the maximal branching factor?
3. Let $N=2$. Use breadth-first-search to find a solution and draw the search tree.
4. Find a (non-trivial) admissible and consistent heuristic for the problem, and show that it is admissible and consistent.
5. Let $N=2$. Apply A^* with that heuristic to the problem, and draw the search tree.

Exercise 3.3

Prove each of the following statements:

1. Breadth-first search is a special case of uniform-cost search.
2. Breadth-first search, depth-first search, and uniform-cost search are special cases of greedy search.
3. Uniform-cost search is a special case of A^* search.

Exercise 3.4



On the picture above, you see a map showing the six regions of an imaginary country. Now consider the problem that you want to colour the map with three colors, **red**, **blue** and **green**, such that no adjacent regions have the same color.

1. Explain why this problem is suitable for an *iterative improvement* algorithm, rather than the other search algorithms from the lecture.
2. Give a suitable representation for the states of the colouring problem.
3. Give the number of possible states of the problem (including those states that do not solve the problem). What can you say about the size of the search tree?
4. Assume the start configuration where all regions are coloured **red**. Use the hillclimbing algorithm to find a solution. Indicate each step. Hint: As an evaluation function for states, use the number of adjacent regions that have the same colour, and minimise this value during hillclimbing.
5. Assume the start configuration where Northern Territory, Maid's Horn, Westend and Emperor's Cliffs are coloured **green**, Midlands is coloured **blue** and South Cape is coloured **red**. Again, use the algorithm and explain what is happening.