Foundations of Artificial Intelligence

Prof. Dr. B. Nebel, Prof. Dr. W. Burgard — University of Freiburg
C. Plagemann, P. Pfaff, D. Zhang, R. Mattmüller — Department of Computer Science
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Exercise Sheet 3

Due: Friday, May 11, 2007

Exercise 3.1 (Hillclimbing search)

Consider the Traveling Salesman Problem on the cities $\{a, b, c, d, e\}$ with the symmetric cost matrix

$cost =$

	a	b	c	d	e
a	0	2	7	3	6
b	2	0	3	12	10
c	7	3	0	2	8
d	3	12	2	0	5
e	6	10	8	5	0

A tour is a closed path that visits every city exactly once. The cost of a tour is the sum of the distances of the edges used. Perform a hillclimbing search for a tour with minimal cost starting with the tour $t_0 = [a - c - b - d - e - a]$. The neighborhood of a tour t consists of all tours obtained from t by visiting a pair of cities visited consecutively in t in the reversed order (i.e. in this problem, each tour has exactly five neighbors). Draw the resulting search tree.

Exercise 3.2 (CSPs)

The $SEND + MORE = MONEY$ problem consists in finding distinct digits for the letters D, E, M, N, O, R, S, Y such that S and M are different from zero, i.e. no leading zeroes, and the equation

$$SEND + MORE = MONEY$$

is satisfied.
Formulate the problem as a constraint satisfaction problem, i.e. give the variables, constraints, etc. Give a solution.

Exercise 3.3 (Sudoku)

Show how *Sudoku* puzzles can be represented as graph coloring problems in which fixed colors are already assigned to certain nodes at the beginning. Describe an algorithm transforming a given Sudoku into an equivalent graph coloring problem. (Give the nodes and edges of the graph, the set of possible colors and the initial colorings.)
For the definition see `http://en.wikipedia.org/wiki/Sudoku`.

The exercise sheets may and should be worked on in groups of three (3) students. Please write all your names and the number of your exercise group on your solution.