Algorithmic Bioinformatics I: Exercises
Assignment 8

Deadline: Tuesday, 30.06.2009, 10 ct

ATTENTION: The exercise sheet has to be handed in to Lukas Windhager. Room 402. Lukas.Windhager@bio.ifi.lmu.de

Exercise 1 (Twofold-SAT):
Consider the language "twofold-SAT" which contains all Boolean formulas that have at least two satisfying assignments. Show that SAT can be reduced to twofold-SAT.

Exercise 2 (1-in-3-SAT):
A CNF formula $F$ is exactly satisfiable if there is an assignment such that in every clause exactly one literal is true. For the 1-in-3-SAT problem we consider exactly satisfiable formulas in 3-CNF. Construct a reduction from 3-SAT to 1-in-3-SAT.

Hint: For each clause introduce a new set of variables $\{a_1, \ldots, a_6\}$ and represent each original clause by several new clauses.

To prove the correctness of your reduction, show that the original formula is satisfiable if and only if the new formula is exactly satisfiable. To which complexity class belongs 1-in-3-SAT?

Exercise 3 (THREAD):
(a) Construct the threading problem for the following 1-in-3-SAT formula:

$$(u_1 \lor \neg u_2 \lor \neg u_3) \land (\neg u_1 \lor \neg u_2 \lor u_4) \land (u_1 \lor u_3 \lor \neg u_4) \land (\neg u_2 \lor u_3 \lor \neg u_4)$$

(b) Is this formula satisfiable? State a satisfying assignment.

(c) What is the corresponding threading?

Exercise 4 (MST Approximation for TSP):
Implement the MST approximation for the TSP. We assume that the original graph is fully connected and the distances fulfill the triangle-inequation $d(A, B) \leq d(A, C) + d(C, B)$. Your program should read a file with a distance matrix as provided on the homepage.