Algorithmic Bioinformatics I: Exercises
Assignment 6

Deadline: Tuesday, 16.06.2009, 10 ct

Exercise 1 (Palindrome):
A palindrome is a word $w = w_1w_2\ldots w_n$, that can be read the same way in either direction ($w_x = w_{n+1-x}$).

(a) Given a word $w \in \{0, 1\}^*$ on the tape of a 1-tape-DTM. Describe the workflow of a DTM which decides whether the word is a palindrome.

(b) Analyse the runtime behaviour of this DTM.

(c) Solve a) and b) for the general case of a k-tape-DTM, i.e. there are k-1 additional working tapes, which may be used like the input tape (they have their own reading/writing head). How many tapes are necessary to solve the problem more efficiently than the 1-tape-DTM?

Exercise 2 (Enumeration):
A (simplified) metabolic network is a graph whose nodes are molecules that are metabolized in a cell and whose edges are reactions from an educt molecule A to a product molecule B. Edges are only present for reactions which are catalyzed by enzymes of the cell. Necessary coenzymes or additional reaction molecules are ignored. Describe an algorithm for the complete enumeration of all simple (cycle-free) reaction paths between a given educt and a given product (i.e. between two given nodes).

Exercise 3 (Roadblock):
Consider the roadblock problem presented in the lecture. Given a colored graph, target nodes for both players A and B and the starting positions (nodes) of the players/cars. Describe a general procedure to solve the decision problem: Is there winning strategy for player A? Motivate why the algorithm is correct.

Exercise 4 (Towers of Hanoi):
Implement a recursive and an iterative version of the Towers of Hanoi problem. Input parameters are the number of used disks, starting and target positions. Your program has to execute both algorithms, print all moves and compare the results of each move. Do you expect differences? Motivate your answer.