Zaawansowane Techniki Algorytmiczne, Mirosław Kutyłowski 2016

"take-home problems"

1) Given a graph G in a form of adjacency matrix: $A(i,j)=1$ iff there is an edge (v_i, v_j).

Design a parallel algorithm that returns a matrix V such that $V(i,j)=1$ iff there is a path between v_i and v_j of length at most 16. Discuss time and work of this solution.

2) There is a network of n nodes located on a ring: each node can communicate only with its neighbours on the ring. We aim to assign 2 colors to nodes so that no two neighbor nodes have the same color. How to achieve this with a distributed algorithm executed by the nodes? We assume that the nodes have no information about location of nodes on the ring. Provide any reasonable (and correct) solution.

3) There is a deck of 24 cards sorted according to their standard order. We aim to permute them at random. In one step we choose two cards at random and with probability 0.5 exchange their positions.

Give *some* time bound T so that after T steps probability distribution of the cards and the uniform distribution on the set of permutations over 24 cards have total variation distance at most 0.01.