5th Homework Assignment

Spring Semester 2017
Prof. Helmut Alt

Introduction to Algorithms

Due April 10, 2017, 10 a.m.

Exercise 1

8 points

Determine and analyze efficient algorithms for the following graph problems.

(a) Is an undirected graph acyclic, i.e., a forest? *Hint:* dfs.

(b) Is a directed graph acyclic?

(c) Find a path which traverses each edge of an undirected connected graph at least once. *Hint:* dfs.

(d) Find a cycle in an undirected connected graph which traverses each edge exactly once, if such a cycle exists.

Hint: Show that this is the case, exactly if all vertices have an even degree.

Exercise 2

7 points

(a) For directed and undirected graphs give the different types of edges (forward-, backward-, tree-, and cross-edges) a graph can have based on a dfs-tree. Explain your answer.

(b) Solve the same problem for bfs-trees.

Exercise 3

5 points

Show that any directed acyclic graph (dag) has at least one vertex with outdegree 0 and at least one with indegree 0.