Lab 10

EXERCISE 1. Explore the definition of the class GRAPH:

- **(i)** Represent graphs of your choice and explore the operations to find outgoing edges, to insert vertices and edges, and to remove them.
- **(ii)** Implement an operation *incomingEdges* that returns for a given vertex v all edges (w, v) in your graph.
- **(iii)** Modify the class such that an edge is stored only once, but participates in two doubly linked lists providing outgoing and incoming edges of different nodes (see slide 299).
- **(iv)** Compare the space requirements of your modified class with the original class GRAPH.
- **(v)** Compare the time required for basic operations (insertion/deletion of edges, determination of outgoing/incoming edges) of your modified class with the original class GRAPH.

EXERCISE 2. Extend the definition of the class GRAPH to a class GRAPHTRAVERSAL:

- **(i)** Implement breadth-first search on graphs.
- **(ii)** Implement depth-first search on graphs.
- **(iii)** Extend the provided test cases.

The following exercise is suggested for further studying graph exploration.

EXERCISE 3.

- **(i)** Use a directed graph to represent the search for the n-queens problem discussed in the lectures. Implement the backtracking-based algorithm to solve this problem.
- **(ii)** Implement the branch-and-bound strategy for the travelling salesman problem.
- **(iii)** Implement a backtracking algorithm to find a path out of a maze.