ADS 1 — problem sheet 6

Exercise 1: Modify Bellman-Ford algorithm to detect the existence of a negative cycle reachable from a given vertex v_0. Can you print that cycle?

Exercise 2: In a castle there are four types of doors and four types of keys. Each door can be opened only using corresponding type of a key. Find a shortest way between two rooms in this castle.

Exercise 3: During the coronavirus pandemy the citisens of a city are allowed to go out only for shortest possible walk around their house. Design an algorithm which for every vertex of a valued oriented graph finds the length of a shortest cycle the vertex is contained in.

Exercise 4: Dijsktra algorithm can be also seen as relaxation algorithm and in that sense it can be run on a graph with negative lengths (but no negative cycle) and we know that in case it will terminate, it will compute distances from a given vertex v_0.

Find a graph G for which the Dijsktra algorithm will run for exponential time. Which algorithm will beat it?

Excercise 5: We want to bring tourist by flight to Czech republic. We have list of airports and lift of flights for

which we know the source airport and departure time and the destination aurport and arrival time. We want to find

1. Fastest way to Czech Republic
2. Fastest way with minimum number of transfers.

Excercise 6: Design as effective algoirhtm as possible to find minimum spaning tree in a weighted graph with integer weights in a range from 1 to 5.

Excercise 7: Given a minimum spaning tree T of a graph G. How to find the second smallest?