VE477
Introduction to Algorithms

Lab 4

Manuel — UM-JI (Fall 2021)

Goals of the lab

- Course application
- Data sctructures
- Python Object Oriented Programming

Unless specified otherwise, all the programs are expected to be completed in Python or O'caml.

1 Programming

In the lectures it was mentioned that Dijkstra algorithm can be best implemented using Fibonacci heaps. In this lab we want to implement the heap part.

1. In a class implement *all* the following operations for the Fibonacci Heap data structure.
   - `MakeHeap`
   - `Minimum`
   - `Union`
   - `Delete`
   - `Insert`
   - `ExtractMin`
   - `DecreaseKey`

   Note: define a clean and clear API as Fibonacci Heaps are to be reused in a future lab.
2. Present the time complexity of each operation.
3. Comparing the Fibonacci heap to the simple min-heap and identify the advantages and disadvantages of Fibonacci heap.
4. Explain in which circumstances Fibonacci heaps should be preferred over other types of heap.

2 Interview Problems

- Given an array A of size n, split it into as few subarrays as possible, with the property that for each of them the gcd of its first and last elements must be larger than 1.
- Write a short program allowing to expand a binary tree into a linked list with all elements in increasing order.