

VE477

Introduction to Algorithms

Lab 3

Manuel — UM-JI (Fall 2021)

Goals of the lab

- Course application
- Algorithms implemented in OCaml
- Running time

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

1 Programming

1. Implement the following algorithms presented in the lectures:
 - a. Sort and count (1.44|1.63);
 - b. Gale-Shapley (2.15|2.79);
2. In assignment 1, exercise 5, question 1 the *Knapsack problem* is introduced and two ideas to solve it are proposed.
 - a. Implement both strategies and run each of them on a counter example;
 - b. Search how to properly solve the Knapsack problem and implement the solution;
3. Run each of the previous implementations on various input sizes, time how long it takes to complete the program, and compare the results to the ones provided in table (2.11|2.75). Write a short report presenting the results.
4. Describe topological sort and implement it in OCaml.

2 Interview problems

- You are given an array A containing positive integers. Find the maximum possible sum of elements of A which is divisible by three.
Example. For $A = [3, 6, 5, 1, 8]$, the maximum sum is 18.
- In an oasis in the middle of the desert lives an very old and isolated community composed of 95 blue and 5 red eyed people. According to their ancient believes:
 - anyone with red eyes is evil, but nobody tells them or act is a special way with them;
 - they are forbidden to check their eye color into any reflective surface;
 - anyone discovering they have red eyes must commit suicide on the evening, when alone at home¹;
 - nobody is allowed discuss about each others eyes color;

One day a lost explorer enters the oasis and as the whole community is gathered he says: "Whahoo, red-eyed people! I had never seen any before."

Assuming of the people of the community have enrolled in VE477, what will happen and when?

¹They will only be discovered on the next day.