Signature retake exam – mock exam

Name: .....

Data structures and algorithms (GEMAK117-MA)

May 21, 2024

Neptun code: .....

Part 1: theoretical questions (15 points)

I will ask a few definitions and theorems and one algorithm from the glossary.

Exercise 1 (6 points)**.** State the following definitions (1 point each):

a) whole quotient, div operation

b) small o notation

c) algorithm

d) Fibonacci numbers

e) congruence

f) multiplicative inverse

Exercise 2 (6 points)**.** State the following theorems (2 points each):

a) reduction theorem (of the greatest common divisor)

b) number of digits (in base b)

c) the "master theorem"

Exercise 3 (3 points)**.** Write down the algorithm for **modular exponentiation**.

Part 2: exercises (15 points)

I will pick 3 of the 6 exercise types seen in the practical midterm.

Exercise 4 (5 points)**.** Using the extended Euclidean algorithm, calculate the greatest common divisor $d^\star$ of $a = 410$ and $b = 305$, then write $d^\star$ as a linear combination (with whole number coefficients) of a and b.

Exercise 5 (5 points)**.** Encode the message `PETER PAN` using the Huffman encoding. What is the coded message, and what is the average code length per character?

Exercise 6 (5 points)**.** Sort the array $\mathrm{A} = [1, 4, 5, 3, 4, 1, 5, 1]$ using `BINSORT` (aka counting sort).

Scoring

Total 30 points, pass: 15+ points.