Lab Assignment 3

CS 361 – Principles of Programming Languages I

Fall 2021

Problem

Write a C++ program that (i) reads all numbers from a file *data.txt*; (ii) uses the quickselect algorithm[1] to compute the 25-th percentile, the 50-th percentile, and the 75-th percentile of these numbers; and (iii) outputs the computed percentiles to the terminal. For the output, simply output all three numbers separated by space. Do not output anything else; do not ask the user for input.

Input File. The numbers in the file *data.txt* are all integers. Each line of the file contains a single number. The first number of the file states how many numbers follow, it should be ignored when computing the percentiles.

Percentile. The *p-th percentile* of a set S is the smallest element e in S such that at least $p\,\%$ of the elements in S (including e) are smaller than or equal to e. To compute the p-th percentile, implement a function

```
int percentile(int p, int S[], int size)
```

which takes a percentage-value `p` and a (potentially unsorted) array `S` as input and returns the corresponding percentile. Your implementation should work for any `p` with $0 \leq \texttt{p} \leq 100$ (not just 25, 50, and 75).

Do not use third party libraries. Do not sort the array; your program should run in $\mathcal{O}(n)$ (expected) time.

Submission

For your submission, upload the file *percentile.cpp* with your implementation to Canvas.

This is an individual assignment. Therefore, a submission is required from each student.

Deadline: Sunday, October 17, 11:59 pm.

[1] See *https://en.wikipedia.org/wiki/Quickselect*.