

Object-oriented Programming

Assignment Sheet No. 5

Date: November 22

Exercise 5.1 (Functions)

Implement a function `celsius_to_fahrenheit(float t)` that converts a temperature `t` given in degree Celsius to a temperature in degree Fahrenheit, and a function `fahrenheit_to_celsius` that converts in the opposite direction. Write a program that tests your functions.

You can use the following formula: $T_{\text{Fahrenheit}} = \frac{9}{5} \cdot T_{\text{Celsius}} + 32$

Exercise 5.2 (Functions and Vectors)

Implement the following functions operating on a `vector<double>`.

- `sum`: Returns the *sum* of the elements; shall return 0 if the vector is empty.
- `average`: Returns the *average value* of all elements; shall return 0 if the vector is empty.
- `median`: Returns the *median* of all elements; shall return 0 if the vector is empty.

Choose appropriate parameter and return types for your functions. Write a small test program for demonstrating your functions.

The median of a **sorted** sequence x_0, \dots, x_{n-1} is

$$\begin{cases} x_{\lfloor \frac{n}{2} \rfloor} & \text{if } n \text{ is odd} \\ \frac{1}{2} (x_{\frac{n}{2}-1} + x_{\frac{n}{2}}) & \text{if } n \text{ is even.} \end{cases}$$

Please note that we do not require that the input vector passed to the `median` function is sorted.

Example:

```
Input vector: 2.5 6 -3 1 8.2 1.5
sum = 16.2
average = 2.7
median = 2
```

Exercise 5.3 (Functions and Reference Parameters)

Implement a function `prefix_sum` which is given a vector of integers and modifies the vector in the following way. Let $v_{\text{old}}[i]$ be the value of the i -th element of the vector before and $v_{\text{new}}[i]$ the value after `prefix_sum` has been called, then

$$v_{\text{new}}[i] = \begin{cases} 0 & \text{if } i = 0 \\ \sum_{j=0}^{i-1} v_{\text{old}}[j] & \text{if } i > 0. \end{cases}$$

Choose appropriate parameter types for `prefix_sum` and write a test program that demonstrates the function.

Example:

Input vector: 2 5 3 0 1 6 3 2

Output vector: 0 2 7 10 10 11 17 20