Advanced Programming Techniques
ExAdvPT
Winter Term 2014/2015

Assignment sheet A

Assignments that are marked with *StudOn submission* are **mandatory** and must be submitted via StudOn in time – please see there for deadlines.

Language Rodeo

Implement the following four tasks in C++, D and Python.

1 Coding: Range sum

Write a program that queries the user for two numbers and sums the numbers in that range.

2 Coding: Factorial

Write a program that prompts the user to enter a number and then uses a `for` loop to calculate the factorial of the given number and writes it to the standard output.

Verify your program at least against the following *test cases*, it should at least pass the first line. If it fails any of the other test cases, you should find the cause.

$$0! = 1 \quad ; \quad 1! = 1 \quad ; \quad 6! = 720 \quad ; \quad 12! = 479001600$$
$$13! = 6227020800 \quad ; \quad 21! \approx 5.1091e19$$
$$35! \approx 1.0333e40 \quad ; \quad -1! = ?$$

3 Punctuation

The program shall read a line from standard input and print the line to standard output without punctuation. The resulting program should be usable as a filter like this:

```
# ./punctuation < with_punct.txt > no_punct.txt
```

Have a look at the following headers / library functions: `<cctype>` (C++), `std.ascii`(D) and `string.punctuation` (Python).

4 Matrix-matrix product

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The purpose of the program is to read two matrices from standard input and write their product to standard output.

The matrix should be stored consecutively in memory. Implement a Matrix class with overloaded arithmetic and access operators. Do not use any libraries like `numpy`!

The program shall first read three integral numbers, in the following denoted s_1, s_2, and s_3. They specify the dimensions of the matrices, $m_1 \in \mathcal{R}^{s_1 \times s_2}, m_2 \in \mathcal{R}^{s_2 \times s_3}, m_3 \in \mathcal{R}^{s_1 \times s_3} = m_1 m_2$.

It then reads $s_1 \times s_2$ numbers that are used to populate m_1 row by row, and then $s_2 \times s_3$ numbers that are used to populate m_2 analogously. Handle all possible input errors and print a comprehensible error message in case of an incorrect input.

The program now computes m_3 before it is eventually written to standard output with line breaks after each row and white space as separators.

Store your solutions in files named `matproduct.cpp`, `matproduct.d`, `matproduct.py` pack them into a zip file called `assignmentA4.zip` and submit them via StudOn.

C++ Variables and Basic Types

5 Literal constants

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Determine the type of each of these literal constants:

(a) `-10` ____________________

(b) `-10U` ____________________

(c) `false` ____________________

(d) `-10.` ____________________

(e) `-10E-2` ____________________

(f) `'\t'` ____________________

6 Names

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Which, if any, of the following names are invalid?

(a) `int double = 3.14159;` □ correct □ invalid

(b) `bool catch-22;` □ correct □ invalid

(c) `float Float = 3.14F;` □ correct □ invalid

(d) `char _;` □ correct □ invalid

(e) `char 1_or_2 = '1';` □ correct □ invalid

7 Code Fragment: sum i

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Given the following program fragment, what values are printed?

```
int i = 100, sum = 0;
for( int i = 0; i != 10; ++i )
    sum += i;
std::cout << "  i: " << i << std::endl;
std::cout << "sum: " << sum << std::endl;
```

`i:` ______________________

`sum:` ______________________

8 Code Fragment: sum ii

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What is the output of the following program fragment?

```
const unsigned int length1 = 10U, length2 = 12U;
unsigned int sum = 0U;
for( unsigned int i = 0U; i < length1-length2; ++i )
    sum += i;
std::cout << "sum: " << sum << std::endl;
```

`sum:` ______________________

9 Code Fragment: sum iii

What is the output resulting from the following program fragment?

```
unsigned int sum = 0U;
for( unsigned int i=100U; i>=0U; --i )
    sum += i;
std::cout << "sum: " << sum << std::endl;
```