

## Sheet 1 - Basic control flow

Practical assignments are corrected in the exercises on *Mo 24 Oct. 12:00*  
Single submissions!

### Assignment 1 (Getting started, 1 points)

- a) Setup your development environment and create an empty project with a file 'main.cpp'.
- b) Insert, compile and run the following snippet:

```
#include <iostream>

using namespace std;

int main( int argc, char** argv) {
    cout << "Hello_world" << endl;
}
```

Please phrase in your own words what this code does and what each line means. Where is a function definition? Is there a function call?

- c) Write a program asking the user for his/her name and birth day, month and year. Output a welcome message to the user including his name and age (The current date is not needed to be queried, you can explicitly encode it)

**Note** It is important that you understand and are able to explain any code you write. If you have questions often looking into <http://www.cplusplus.com/files/tutorial.pdf> might help. Of course you can also ask your tutor any time.

### Assignment 2 (Numbers and Operators, 1.5 points)

- a) Basic Operations:

```
int i = 10;
int j = 23;
float f = 3.141f;
double d = 2.718281828459045;
```

What is the result of the following expressions? State the **type** of the result (int/float/double) and the numerical **value**.

$i/j$ ,  $j/i$ ,  $i/2$ ,  $j/2$ ,  $i\%2$ ,  $j\%2$ ,  $(j/3) * 3 + j\%3$ ,  $f*f*5$ ,  $f/d$ ,  $d/f$ ,  $d*i$ ,  $d/i$

- b) Basic Functions

```
int min( int a, int b ) {
    if( a < b ) {
        return a;
    } else {
        return b;
    }
}
```

Implement also the functions `max`, `abs` (absolute value), `square` and `mean` for `int`.

c) What is the result of `mean( min( max( 10, 1 ), abs( -9 ) ), 6 )` ?

### Assignment 3 (Loops, 2 points)

a) A loop execute the same code several times in a row. Here is an example:

```
int a = 0;
while( a < 10 ) {
    cout << "This_is_the_" << a << "_th_time!" << endl;
    a ++;
}
```

Execute and understand this program. Rewrite the while-loop with

- a for loop
  - a do .. while() loop
  - a while loop where the conditional is set to `true` using `if(...)` `break;` instead.
- b) Write a function `sumfirstN(n)` that sums up the first  $n$  natural numbers using a loop. (Extra: Can you do it as well without loops and recursion ?)
- c) Fibonacci-Numbers are given by the formula  $a_0 = 0, a_1 = 1, a_n = a_{n-1} + a_{n-2}$ . Implement a function `fib_loop(i)` that calculates  $a_i$ . Implement it using a loop (e.g. for or while but **without** recursion).

### Assignment 4 (Recursion, 1.5 points)

- a) Implement the function `'fib_recursion(i)'` calculating the Fibonacci numbers - this time using recursion. What are the Fibonacci numbers  $a_1, a_5, a_6$ . What happens if you calculate  $a_{100}$  ?
- b)  $(x + y)^n = \sum_{i=1}^n b_i^{(n)} x^i y^{n-i}$  with  $b_i^{(n)} = \binom{n}{i}$  are called the binomial coefficients. Write a function to calculate  $b_i$  using the recursion:  $\binom{n}{i} = \binom{n-1}{i-1} + \binom{n-1}{i}$  (remember  $\binom{1}{1} = 1, \binom{n}{0} = 1, \binom{n}{n} = 1$ ).
- c) Output Pascal's triangle<sup>1</sup> until level 6.

### Assignment 5 (Debugging, 2 points)

For an introduction to debugging please see e.g. Tutorial1<sup>2</sup> or Tutorial2<sup>3</sup>. Learn how to explain and do the following tasks:

- starting the debugger
- breakpoints
- Step In, Step Out, Step Over
- Variables window
- Call Stack window

Be able to show all of those steps for your previous programs in the next exercise!

**Good luck !**

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<sup>1</sup>[http://en.wikipedia.org/wiki/Pascal%27s\\_triangle](http://en.wikipedia.org/wiki/Pascal%27s_triangle)

<sup>2</sup>[http://www.youtube.com/watch?v=C0vDKXIq\\_9A](http://www.youtube.com/watch?v=C0vDKXIq_9A)

<sup>3</sup><http://www.youtube.com/watch?v=eEJ5xK07c3o>