

# Handout - Loops and Debugging

## Preamble

All the code on this handout assumes that it is placed inside the `main()` function as follows:

```
#include <iostream>
using namespace std;
```

```
int main() {
    // your code
}
```

## Loop

### While loop

Repeatedly executes the body as long as the condition stays true.

```
int i = 0;
while(i < 10) {
    // print the message 10 times
    cout << "hello from loop number " << i << "\n";
    i++;
}
```

Sometimes we want to exit the loop early, before the condition becomes false, we use the keyword **break** in that case. This will jump to the line just after the loop.

```
int i = 0;
while(i < 10) {
    // print the message only 3 times
    cout << "hello from loop number " << i << "\n";
    if(i == 2)
        break;
    i++;
}
```

If we want to skip the rest of the body without leaving the loop, we use the keyword **continue**.

```
int i = 0;
while(i < 10) {
    if(i % 2 == 1)
        continue;
    // print the message only when i is even
    cout << "hello from loop number " << i << "\n";
    i++;
}
```

### For loop

This pattern of initializing a variable, using the variable in a condition and at the end updating the variable is used very often. So c++ allows us to make this shorter with a for loop.

```
for(int i = 0; i < 10; i++) {
    // print the message 10 times
    cout << "hello from loop number " << i << "\n";
}
```

We don't have to use all 3 parts in the for loop, we can leave some of them empty. Although if we leave 2 or more empty we might as well use a while loop.

```
int i = 0;
for(; i < 10;) { // Don't do this
    // print the message 10 times
    cout << "hello from loop number " << i << "\n";
    i++;
}
```

## Example: Primality test

Task: Check for a given number `n` if it is a prime number.

```
bool prime = true;
for(int i = 2; i < n; i++) {
    if(n % i == 0) {
        prime = false;
        break;
    }
}
```

## Debugging

What to do if your program doesn't work?

- Compile your program and let the compiler tell you if there is a syntax error and if yes on which line.
- If the program crashes check your assumptions with `assert(conditions)`
- Use `cerr << var` to output information that might help determine what's going wrong
- Use the VSCode debugger

## VSCode Debugger

How to use the VSCode Debugger:

- Make sure that `task.json` and `launch.json` are properly configured in `.vscode` folder
- Build the project with Terminal->Run Build Task (`Ctrl-Shift-B`)
- Set at least one breakpoint by clicking left of the line number.
- Start debugging with Debug->Start Debugging (`F5`)