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392042 Programming in C/C++ (V+Ü) (WiSe 2021/2022)

Date: Wed 10-12 Room: GZI & ONLINE Period: 11.10.2021-04.02.2022

Motivation

Knowledge and proficiency in a variety of programming languages is essential for a computer scientist nowadays. C/C++ is a very powerful language used in science and industry in diverse fields of application, including computer graphics, bioinformatics, and for hardware-oriented programming. Compared to other languages such as Java or Python, C/C++ gives the programmer more control over the resources of the system and is directly translated into machine code, which allows writing highly performant programs and is especially an advantage when processing large amounts of data. The course builds on concepts already known from the first semesters and transfers them to the C/C++ programming language in order to achieve quick learning success.

Course description

The course provides an introduction to the C/C++ programming language. In addition to learning the syntax and essential language elements such as classes and functions, loops and branches as well as pointers and references, some important data structures from the standard library are introduced and the focus is on efficient implementation as well as good readability of the code. The course relies on an interactive concept: new learning content is presented by means of examples and can be directly tested by the students on their own computers. For pre- and post-processing of the content, reference is made to online tutorials and weekly exercises are provided for the students to work on until the next session. The course performance includes active participation and a portfolio of successfully completed exercises. Students should develop confident usage of C/C++ and be able to use the learnt skills in future projects or theses.

Learning objectives

Upon successful completion of this course, students will be able to...

- *understand* the structure, syntax, and semantics of the C/C++ language.
- *name* and *describe* the most important data types and control structures.
- *create* their own programs in C/C++ and *use* them to solve problems.
- *utilize* tools such as compilers or debuggers wisely when programming.
- *evaluate* the performance of their code and *identify* sources of errors.
- *present* their own code as well as *provide* constructive *feedback* to others.

Module assignments

- Module 39-Inf-EGMI Ergänzungsmodul Informatik
- Module 39-Inf-MIKE Modularisierter individueller Kompetenz-Erwerb
  (or *individual supplementary area*: 2 LP)

Recommended previous modules

- Module 39-Inf-1 Algorithms and Data Structures
- Module 39-Inf-2 Object-oriented programming

Course credit and examination

- *Portfolio of exercises (ungraded examination)*

  Three exercises are provided each week, of which an average of two must be successfully completed and handed in. At least once a semester, students are expected to present their solution to the others.

  The tasks are to be solved in the programming language C/C++. The submission of the solutions takes place via the LernraumPlus. It is possible to evaluate the correctness of the results before uploading the source code.

- *Active participation* in the course is desirable.

  In the presence exercises, new learning content is developed together with the students and can be tried out by them directly. The teacher is available during the time for questions and, if necessary, provides assistance.

Topic selection

- Constants and variables
- Compiler and preprocessor
- Data types and definitions
- Instructions and expressions
- Control structures
- Functions and templates
- Memory management
- Stack and heap
- Debugging
- Classes and structures
- Operator overloading
- Headers and namespaces
- Class variables and methods
- (Multiple) Inheritance
- Enums
- Arrays, vectors, sets, and maps
- Bitsets and bitwise operators
- Threads and parallelization
- Cast operators
- Exception handling
- Pointers and references
- Standard Template Library (STL)

Websites

- https://www.jetbrains.com/clion
- https://code.visualstudio.com
- https://repl.it/languages/cpp
- https://www.learncpp.com
- https://www.cplusplus.com
- https://cppreference.com

Literature

- B. Stroustrup: The C++ Programming Language