COMPUTERGESTÜTZTES EXPERIMENTIEREN II
(Computer-Assisted Experimentation II)

P R A C T I C A L
Programming in C/C++

Basics I

1. Write a program that prints the numbers 1 through 10 on the the console window. The console window emulates a console that in former times was a line mode text terminal.

2. Modify the previous program such that you print the numbers 1 through N whereby you enter the value of N on the keyboard.

3. Write a program that calculates the sum of the integer numbers from 1 through N in a loop whereby you enter the value of N on the keyboard.

Objectives: structure of a main program (*main*), data types *int* and *float*, simple formatted inputs and outputs (*printf, scanf*), entry-controlled loops *for* and *while*, arithmetic expressions, sequence of operations in arithmetic expressions, introduction to C and to Borland C++ Builder Console Applications.

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Basics II

1. Draft a program that determines all prime numbers up to an upper limit O by noting it in a flow chart. Test the correctness of the program maually by determining the prime numbers for e.g. an upper limit of O = 5.

2. Implement the program in C and test it for various upper limits O.

3. Try to improve the speed of the program. Test only odd candidate numbers greater than 2. And when testing a candidate number N for primeness try divisors only up to $\sqrt{N}$.

4. The Sieve of Eratosthenes is an efficient algorithm for determining all prime numbers up to a limit O. For its implementation use an integer array to store all natural numbers to the limit O. Optional: use pointers to access individual array elements.

Objectives: data type *double*, arrays (arrays versus pointers), static and dynamic value assignment, control structures: *if, switch*, exit-controlled loop *do ... while*, *break, continue*.

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Basics III

1. Write a program that reads N measured data pairs (x_i, y_i) from the keyboard of the console and writes them into a file. The number of data pairs and the name of the file should be freely selectable.

2. Write a program that reads the measured data (N and (x_i, y_i)) from a specified file and performs a simple linear regression to determine the parameters of the regression line $y = a + bx$. Print out the intercept a and the slope b as well as their statistical errors.

Objectives: data type *char*, strings, string operations, input from and output to files (*fscanf, fprintf*), opening and closing of files (*fopen, fclose*), structure and invokation of subprograms (functions and procedures), examples of subprograms, simple linear regression

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Basics IV

In this set of exercises you start to create programs with a GUI. The GUI is implemented using objects. As a consequence we have to get familiar with and use the object extension of C, C++. The components of the GUI are taken from VCL (Visual Component Library) and are used in a Forms Application.

1. Write a program whose functions will be controlled by buttons. Similarly to the previous exercise implement the functions for reading a specified file of data pairs (x_i, y_i), for performing a simple linear regression, and for writing the data pairs into another specified file. The resulting parameters of the regression should be presented in Edit windows. The regression line along with the data pairs should be shown in a graphic panel.

2. Modifiy the previous program such that its functions will be controlled using a menu. Optionally, extend the program such that the data pairs can be edited, such that the edited data can be saved to a file, such that a protocol of the regression is witten to a file, and such that the graphics can be printed.

Objectives: introduction to C++Builder Forms Applications with VCL GUI: Buttons, Edit windows, Menus, Open und Save Dialogs, Graphics with TChart.