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Proseminar Algorithmen und Datenstrukturen

Exercise sheet 1

In this tutorial you will create a first C program. We recommend the usage of Emacs as the editor. You can however use your own editor or editing environment if you are familiar with it.

Exercise 1 (A first C program)

a) Create a file with the text editor emacs

Type **emacs helloworld.c &**
Note the "&" at the end. What's happens if it is removed ?
When emacs pops up, enter (type in, do not cut and paste) the following C program, exactly as it appears here.

```
#include <stdio.h>

int main() {
  printf("Hello World!\n");
  return 0;
}
```

You save a file in emacs by typing ctrl-x ctrl-s (for 'save'). You can also save a file to a new or different name by typing ctrl-x ctrl-w (for 'write,' the same as 'save as' in Windows applications) and then entering the new file name at the bottom of the emacs window.

b) Compiling the program

Type in the terminal: **gcc -o helloworld helloword.c**
If you get any error message, you made a mistake in writing your program !

c) Running the program

Type in the terminal: ./helloworld

Congratulations, you've run your first C program !

Exercise 2 (Conditional statements)

a) A new program Type the following program in your favorite editor and try to understand it (look at the cheat sheet for explanations of the commands).

```
#include <stdio.h>

/* Most important part of the program! */
int main()
{
  /* Need a variable... */
  int age;

  /* Asks for age */
  printf( "Please enter your age: " );
  /* The input is put in age */
  scanf( "%d", &age );
  /* If the age is less than 100 */
  if ( age < 100 ) {
     /* Just to show you it works... */
     printf ("You are pretty young!\n" );
  }
  /* I use else just to show an example */
  else if ( age == 100 ) {
     printf( "You are old\n" );
  }
  /* Executed if no other statement is */
  else {
    printf( "You are really old\n" );
  }
  return 0;
}
```

b) Compile and run the program.

c) Modify the program so that the gender is taken into account. Introduce a gender variable:

```
int gender;
```

which takes values 0 for a male and 1 for a female.
Modify the conditional statements so that each age sentence also includes the gender. For example: "You are a pretty young woman!".

```
#include <stdio.h>

/* Most important part of the program! */
int main()
{
  /* Need a variable... */
  int age;
  /* Gender variable */
  int gender;

  /* Asks for age */
  printf( "Please enter your age: " );
  /* The input is put in age */
  scanf( "%d", &age );
  /* Asks for gender */
  printf( "Please enter your gender (0 for male, 1 for female): " );
  /* The input is put in age */
  scanf( "%d", &gender );
  /* If the age is less than 100 */
  if ( age < 100 ) {
    /* and the person is woman */
    if ( gender ) {
      /* Just to show you it works... */
      printf ("You are pretty young woman!\n" );
    }
    else{
      printf ("You are pretty young man!\n" );
    }
  }
  /* I use else just to show an example */
  else if ( age == 100 ) {
        /* Notice the negation symbol:! */
if (!gender) {
 printf( "You are an old man\n" );
}
else {
 printf( "You are an old woman\n" );
}
  }
  /* Executed if no other statement is */
```

```
  else {
    printf( "You are really old\n" );
  }
  return 0;
}
```

Exercise 3 (Programming in C)

Read Chapter 2 from "Brian W. Kernighan, Dennis M. Ritchie: Programmieren in C."

Exercise 4 (Computing effort)

Given is the algorithm from the lecture that searches the longest Upsequence of a sequence of length n. Given are 3 different implementations that need n, n^2 and 2^n steps to finish. The algorithms are executed on a computer where each computing step takes 1 μs. Compute how long each algorithm will run for input sequences of length 100, 1000, 10000 and 100000.

	n	n^2	2^n
100	0,1 ms	10 ms	$4 * 10^16$ years
1000	1 ms	1 s	$3,4 * 10^{287}$ years
10000	10 ms	100 s	$6,3 * 10^{2996}$ years
100000	0,1 s	2h 46min 40s	$3,2 * 10^{30089}$ years