

Note: For every exercise, create ~~an own project~~. Exercises which are not finished in class must be completed at home!

Learning outcome of this set of exercises: Functions, parameters, ~~pointers~~, ~~header and source files~~, ~~using the debugger~~.

Exercise categories:

- A – very basic, intended for inexperienced developers
- B – fair, a little bit more complex but still for starters
- C – challenging, complexity is higher, additional programming constructs may be required

## Exercise 1 – Temperature (A)

Celsius and Fahrenheit

- Write a function which takes a temperature value in Celsius and returns the corresponding temperature value in Fahrenheit.
- Write a second function which takes a temperature value in Fahrenheit and returns the corresponding temperature value in Celsius.
- Calculate the corresponding values for 0°C, 100°C, 0°F and 100°F.

Temperature Converter

- Write a function which takes a temperature in Kelvin and returns ~~(call by pointer)~~ the corresponding values in Celsius and Fahrenheit
- Calculate the Celsius and Fahrenheit Values from 0K to 100K within steps of 100K

Example output:

```
Temperature Converter
=====
0C = 32F
100C = 212F
0F = -17.7778C
100F = 37.7778C

0K = -273.149994C = -459.670013F
100K = -173.149994C = -279.670013F
200K = -73.150002C = -99.669998F
300K = 26.850000C = 80.330002F
400K = 126.849998C = 260.329987F
500K = 226.850006C = 440.329987F
600K = 326.850006C = 620.330017F
700K = 426.850006C = 800.330017F
800K = 526.849976C = 980.330017F
900K = 626.849976C = 1160.329956F
1000K = 726.849976C = 1340.329956F
```

## Exercise 2 – Simple Encoder/Decoder (B)

Write a function which encodes/decodes a string using the following algorithm:

- Every character is shifted one position higher in the alphabet, i.e. 'a' becomes 'b', 'b' becomes 'c' and so on
- The algorithm substitutes only input in the following range: '0'...'9', 'a'...'z' and 'A'...'Z'
- The last character in every range is replaced by the first character in every range, i.e. '9' becomes '0', 'z' becomes 'a' and 'Z' becomes 'A'

Write a second set of function which takes another parameter defining the shift distance.

- In case the shift distance is 2, 'a' becomes 'c', 'z' becomes 'b', 'y' becomes 'a'
- In case the shift distance is 3, 'a' becomes 'd', 'z' becomes 'c' and so on...

Hints:

- ~~String parameters are automatically pointers~~
- ~~Use the functions strcpy, strlen to process the string. Check [www.cplusplus.com](http://www.cplusplus.com) for details on these library functions.~~

Example output:

```
Encode/Decode by shifting character 1 position to the right in the alphabet

Original input: Test input AZaz09. Hello world: 123
Coded input:    Uftu joqvu BAba10. Ifmmp xpsme: 234
De-coded input: Test input AZaz09. Hello world: 123

Encode/Decode by shifting character n=2 position to the right in the alphabet

Original input: Test input AZaz09. Hello world: 123
Coded input:    Vguv kprwv CBcb21. Jgnnq yqtnf: 345
De-coded input: Test input AZaz09. Hello world: 123
```

## Exercise 3 – Roman numbers (C)

Write a functions which translates an integer number (range 1...3999) into a roman representation. The roman number is returned as string. ~~Store the function in an own file roman.h and roman.c~~

Conventions

- I 1
- V 5
- X 10
- L 50
- C 100
- D 500
- M 1000

The numbers are added

- III 3
- VI 6
- XX 20

The numbers 4 and 9 are generated by subtraction, the subtracted number is placed left

- IV 4
- IX 9
- XL 40
- XLIX 49

~~Hint: Use the functions strcpy, strcat to create the output string. Check [www.cplusplus.com](http://www.cplusplus.com) for details on these library functions.~~

Example output:

```
Integer to roman converter

Please enter an integer number between 1 and 3999
1000
1000 = M
Please enter an integer number between 1 and 3999
2000
2000 = MM
Please enter an integer number between 1 and 3999
99
99 = XCIX
Please enter an integer number between 1 and 3999
999
999 = CMXCIX
Please enter an integer number between 1 and 3999
2012
2012 = MMXII

Please enter an integer number between 1 and 3999
```