Exercise 4

1. Write a program which prints the numbers 1 to 10 on the screen. Do this with the `for`, `while`- and `do-while` structures.

2. Write a program which computes the factorial of a nonnegative integrer. The factorial of n is defined as

$$n! = n(n-1)(n-2)\cdots 3 \cdot 2 \cdot 1,$$

   with $0! = 1$. The user should enter the number n, and the factorial is computed if $n \geq 0$. If $n < 0$, the program is terminated.

3. Write a program which forms an evenly spaced grid on the interval $[a, b]$:

$$x_i = a + ih,$$

   where $i = 0, \ldots, n$, $x_n = b$, and

$$h = \frac{b-a}{n}.$$

   Hing: Set up a `double` *type array. The values of* a*,* b *and* n *must be given at the start of the program.*

4. Write a program which asks "Which number am I thinking?" The program should guide the user by saying whether his/her guess is greater or lesser than the right answer. The program is terminated when the user guesses right.

5. Write a program which computes the sum

$$\sum_{k=0}^{n} \frac{x^k}{k!}$$

   when x and n are given. Also print the difference of this sum and the exponential function e^x.

   Hint: You can calculate the factorial as you did in the first exercise. The definition of the exponential function `exp(x)` *is found in the header file* `math.h`.

6. Write a program which tests whether a given positive integer is a prime number. A prime number is a number which is divisable only by 1 and itself. Using your program, prove that 15 485 863 is a prime number.

   Hint: Test whether the given number n *is divisable by* m *for all* $1 < m < n$*. In fact, the range of values for* m *can be further limited. Can you figure out how?*