Exercise 5

1. Consider the following functions. What would be an appropriate return value type for each? What kind of arguments would they accept? Write the functions, and write a main program where you test the functions.

   a) A function which prints the message "Kilroy Was Here." on the screen.

   b) A function which asks the user for an integer and returns this number to the main program.

   c) A function which takes as argument a number x and returns the number $1/(1-x)$.

   d) A function which asks the user for two numbers and returns the greater of them.

   e) A function which prints two given numbers in their order of magnitude.

   f) A function which computes the value of $e^x \sin(x)$ for a given x.

2. Write a program which calculates the growth of a bank deposit. The program should ask the user for the initial deposit, the interest rate and duration of the deposit.

   Hint: Write a function which takes as arguments the data given by the user and calculates the value of the deposit when the funds are withdrawn from the account.

3. Write a function which calculates the sum

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

   for given values of x and n.

   Hint: What arguments would the function receive? What would be its return value type? Write a separate function which calculates the factorial. Make the sum function call the factorial function for each k.

4. Write a program which prints the values of the expressions

$$x, \qquad \sin(x), \qquad x^{2.5}, \qquad \ln x$$

   in a table, when x has the values $-1 + 0.1i$, $i = 0, \ldots, 31$. Do this in two ways:

   a) Write a single function which does the whole thing.

b) Write a function which prints the headers of the table (i.e. `x`, `sin(x)`, etc.) and another function which takes as argument the value of x and prints one row of the table.

5. Functions can also call themselves. This kind of functions are called *recursive*. Write a recursive function which calculates the factorial of an integer n.

   Hint: The factorial $n!$ *of a nonnegative integer* n *is defined as*

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

   Clearly

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

   so $n!$ *can be written in the form*

   $$n! = \begin{cases} 1 & \text{when } n \leq 1 \\ n((n-1)!) & \text{when } n > 1 \end{cases}$$