Programming Techniques
1st Semester 2018/2019

Exercises

Operator ?:

1. Write a program that decides if a number is even or odd (using the operator ?:)

Switch

1. Write a program that performs as a calculator. Your calculator should be able to handle the five basic math operations (add, subtract, multiply and divide) on two input values.

   Your program should prompt the user to enter three arguments: two double values and one character to represent the operation (e.g 2.3, 3.1 and '+' and the result would be 5.4).

For

1. Write a program that given a positive integer number n computes:

$$\frac{1+2+3+...+n}{n}$$

2. Write a program that given a positive integer number n computes its factorial:

$$n! = n \times (n-1) \times ...2 \times 1$$

3. A number is perfect if it is equal to the sum of its proper divisors. Write a program that given a positive integer number determines if it is a perfect number.

   (for example: 6 =1+2+3, so it is a perfect number).

4. (*) Write a program that determines if a given positive integer number is prime. How many comparisons are needed? Can you improve the efficiency by performing less computations?

While

1. Write a program that will ask the user to input n positive numbers. The program will terminate if one of those number is not positive.

2. Change the last program in order to count the number of positive numbers that the user inputs before the program is terminated.

3. Write a program to count the number of occurrences of the letter a in a phrase.

   Obs: In order to know where the phrase ends use a '.'.

4. (*) Given a real valued function $f(x)$, Newton's method allows us to find approximations for its roots, x such that $f(x) = 0$. The approximations are obtained through the iteration scheme:

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

   Write a program that, using Newton's method, computes an approximation of $\sqrt{2}$ with absolute error smaller than 10^{-5}. How many iterations of the method are necessary?

   Obs: Note that $\sqrt{2}$ is the solution of the equation $x^2 - 2 = 0$

Functions

1. Write a function that given two positive integer numbers n and p computes the value of ${}^{n}C_{k} = \dfrac{n!}{k!(n-k)!}$.

2. Write a function that computes the sum of the first n terms of a geometric progression with general term given by : $u_n = a \cdot r^n$. (without using the pow function)

3. (*) Write a program that given a positive integer number n computes the sum:

$$\sum_{k=1}^{n} \frac{1}{k!}$$

   Compare the result with exp(1) and determines the smallest n such that the absolute error of the approximation is smaller than 10^{-5}.

4. (*) Write a function that converts from binary representation to decimal representation.