Test on introduction to programming

The use of computer is necessary. The solution of the problems has to be a unique file (pdf, word or something similar). The file has to include the solution and the codes used

PROBLEM 1

We want to analyze the marks obtained by a group of students in an exam. The objective is to obtain the mean value, the variance and the standard deviation of the results of all the students, The mean, μ, is defined as

$$\mu = \frac{1}{N}\sum_{k=1}^{N} x_k$$

and the variance, ν

$$\nu = \frac{1}{N-1}\sum_{k=1}^{N}(x_k - \mu)^2$$

being x_k each of the N points in the data set. Write a Matlab/Octave script to:

1. Create a random vector named marks with size (100,1). This vector must have random numbers between 0 and 10. These are the marks obtained by students.

2. Create a loop to obtain the mean value of the marks and store it.

3. Using the previous result, create a new loop to obtain the variance.

4. Check the results using the built-in functions `std()` and `var()` in Matlab/Octave.

PROBLEM 2

A projectile shot from the ground, with an inclination angle α and an initial velocity v_0, will follow a parabolic movement. The distance reached by the projectile (x_{max}), the maximum height (y_{max}) and the flight time (t) can be obtained by,

$$x_{max} = \frac{v_0^2 \sin(2\alpha)}{g}, \qquad y_{max} = \frac{v_0^2 \sin^2(\alpha)}{2g}, \qquad t = \frac{2v_0 \sin(\alpha)}{g}$$

1. Write a Matlab/Octave function called `parabolic()` which has inputs v_0 and α and gives the outputs x_{max}, y_{max} and t.

2. Use the function for an initial velocity of $v_0 = 35\ m/s$ and angle $\alpha = \pi/4$.

3. Define a vector `alpha(i)` containing the angles ranging from $\alpha = 0$ to $\pi/4$ in steps of $\pi/8$.

4. Define a loop to obtain the value of y_{max} for every `alpha(i)` of the previous vector and plot the results using `plot()`.