Worksheet 8

General Instructions: Do not copy-paste from this file to terminal. If you have doubts, contact the instructors or TAs. And **do not panic**!

- You should keep all your files in `CS1101/ws08` folder.

- Use `gedit` or `nano` to type your programs.

- The name of the programs should be `prob-n.py` for n^{th} problem.

- Save the output of your program in a text file `prob-n-output.txt`.

- After you finish, create an archive of the folder `ws08` with name `ws08-idnumber.tgz` and upload in WeLearn.

We expect that all programs to have *comments*, particularly the functions.

1. Write a program which takes two integers from the user and returns all prime numbers between the two integers. The result should not depend on the order in which the integers are entered by the user.

2. The exponential of a number (x) is given by:

$$\exp(x) = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \frac{x^5}{5!} \cdots$$

   In general, the nth term is $\frac{x^n}{n!}$. Since the evaluation of $n!$ is time intensive for large n, another way out is to note that

$$T_n = \frac{x}{n} T_{n-1}$$

   where, T_n is the nth term of the series. We may calculate $\exp(x)$ efficiently by using the above relation. Write a program which uses the above relation to evaluate $\exp(\pi)$ within the accuracy of 10^{-4}. Your program should print number of terms of the series (which have been evaluated), the computed value, the actual value and their absolute difference of the two.

3. Write a program that takes three numbers from user and checks whether these three numbers could be the sides of a triangle. [*Hint: To have a triangle, we must have sum of any two sides greater than the third side.*]

   gnuplot

4. Download `data1.dat` from WeLearn. Plot the data using `gnuplot`. The data is roughly a linear function of x. Now, define a function $f(x) = mx + c$, and fit the data using this function. What are the errors in the estimated values of parameters m and c. Plot the data and the fit together in a plot and save it as a `png` image.

5. Download `data2.dat` from WeLearn. Plot the data using `gnuplot`. The data is a nonlinear function of x of the form $\dfrac{x^a}{b + x^c}$ Fit the data using this function. What are the errors in the estimated values of parameters. Plot the data and the fit together in a plot and save it as a `png` image.

6. Download `data3.dat` from `WeLearn`. (i) Fit the squares for the first and the second columns with a straight line. (ii) Fit the data with $\sqrt{a - bx^2}$ and verify that the numbers are commensurate with the previous result. Upload the image of the data and the fits. The fit values of the parameters should be put in the title of the plot(s).

7. Download `data4.dat` from `WeLearn`. (i) Fit the data with an exponential function $f(x) = a\exp(-bx)$. (ii) Fit the log of the data with a straight line and verify that the numbers are commensurate with the previous result. Upload the image of the data and the fits. The fit values of the parameters should be put in the title of the plot.