# Worksheet 5

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

- The first two tasks in this worksheet require you to use Python3 shell. You need to copy paste your work (commands and outputs) to a file using gedit or nano.

- The last few problems in this worksheet will require you to write a program.

- You should keep all your files in `CS1101/ws05` 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 ws05 with name `ws05-idnumber.tgz` and upload in WeLearn.

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- Open `gedit`.

- Open a terminal and start the python shell.

- Complete the next two tasks given below in the python shell in your terminal.

- You will copy-paste the `python` commands and the corresponding outputs in `gedit` and save the file as `prob-N.txt` where `N` is the number of the task. For each task you need to save one file.

- Task 1: *Exploring functions*

    1. Type **python3** to start a python shell

    2. Let, **x = 1** and **y = 2**

    3. Now, define a function by typing (important: leave an empty line at the end)

        ```
        def f(x):
            y = x**2
            print(x, y)
            return y
        ```

    4. Now call the function with an argument 4, i.e. type **f(4)**.

    5. What are the printed *local* values of **x** and y?

    6. What are the global values of **x**?

    7. Save the `gedit` contents as `prob-1.txt`

- Task 2: *Functions with multiple inputs and outputs*

1. A function can have multiple inputs. For example, the following function takes two input arguments in the form of two variables and returns a single variable.

```
def f(x, y):
    z = x/y
    return z
```

2. Define the above in the python shell and check **f(7,3)** and **f(9.0, -2.0)**.

3. A function can have multiple outputs. For example, the following function returns two outputs.

```
def fun(x):
    j = x//2
    h = x%2
    return j, h
```

4. Define the above in the python shell. Try **fun(8)** and **fun(4+5)**.

5. Now, to store the two outputs returned by this function you will need two variables. Check **a, b = fun(13)**. Check the values of **a** and **b**.

6. Save the gedit contents as prob-2.txt

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Examples of programs using functions are available on the course page. Download and run the programs. Your programs (from now on) should follow the format of prog-55.py. We expect that all programs to have *comments*, particularly the functions.

4. In a program, define a function that takes an input argument **x** and calculates the quotient **q = x//2** and remainde **r = x%2** and returns **q** and **r**.
   In the same program, take an input from the user and store it in a variable (say, **s**). Now, call the function **f(s)** with two storage variables (to store the two outputs). See the example above.
   Finally, print the stored variables.

5. Copy and modify the above program, to collect two integers **x** and **y** from the users and store the quotient and the remainder for $(x + 2) \div (y+2)$.

6. Suppose the length of three sticks are given by three numbers. Define a function which takes the three lengths (as arguments) and determines whether these sticks can form a triangle. The function should return True or False depending on whether the triangle is formed or not. Your program should take three numbers from the user and should print whether a triangle is possible or not. [*Hint: three lengths form a triangle if the sum of any two lengths is greater than the third.*]

7. If you need to evaluate mathematical operations (log, sin, cos etc), you need to declare from math import * at the beginning of your program. For example, to find the value of cosine of $60°$, your program should look like:
   from math import *
   print cos(60*pi/180)
   pi gives you the value of $\pi$ and $\theta\pi/180$ converts $\theta$ from degree to radian.
   Define a function which takes an argument $t$ (in degrees) and returns $\sin 2t$. Next write a loop which uses the function to print $\theta, \sin 2\theta$ for $\theta = 0, 10, 20, 30, \ldots, 80, 90$.

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8. Define a function which takes a number ($x$) as argument and returns the $95/100$ power of the same number ($x^{0.95}$). If $x$ is greater than 1, then $f(x) < x$ and $f(f(x)) < f(x)$. Let us suppose, that we start with $x = 10$ and in each iteration we assign $x = f(x)$.

   How many iterations do we need to perform until we get $x < 2$?