**ME1 Computing- Session 6: Functions**

***Learning outcomes:***

- Being able to code user defined functions
- Being able to pass arguments to a function
- Being able to retrieve results from a function

| Please provide feedback at: www.menti.com with code 63 53 57 |
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***Before you start***

In your H drive create a folder *H:\ME1MCP\Session6* and work within it.

***Task 1: Factorial, again***

Write a function, *Factorial*, to compute the factorial of an integer number. The function receives an integer number *n* and returns the value of its factorial.

$$F = n! = n * (n-1) * (n-2) * (n-3) * \dots \dots * 3 * 2 * 1$$

**Answer Question 1**

***Task B: Series expansion, again***

The function $y(x) = e^x$ can be represented by the series expansion:

$$y(x) = \sum_{i=0}^{N} \frac{x^i}{i!} = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} + \cdots$$

Write a function, *ExpSeries*, to approximate *y(x)* with *N* terms, in the range *x = [a:dx:b]*. The function *ExpSeries* receives an array *x* with the interval *[a:dx:b]* specified, the value of *N* and returns an array *y* with the approximated values of $y(x) = e^x$.

(Recycle as much as you can from the script you have written in Tutorial 4, Task C. Also, make use of the function *MyFactorial* that you have created today).

Once the function *ExpSeries* is ready, write a script to plot *y(x)* in the range *x = [-4 : 0.01 : 2]* with *N* = 2, 6, 10, 14.

**Answer Question 2**

***Task C: Sorting data, again***

Write a function, *SortAscending*, that receives an array of numbers and returns the same array sorted in ascending order.

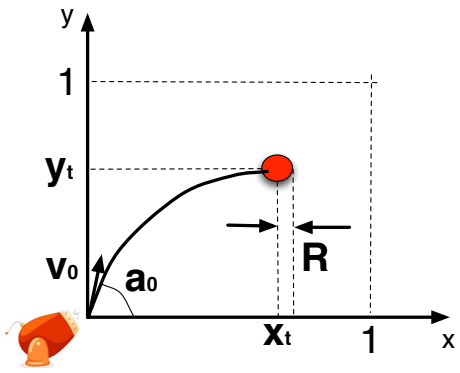
Test the function by generating an array of 50 integer random numbers between 1 and 100 and sorting them.

**Answer Quiz 3**

***Task D: Warfare: the shooting videogame***

Scope of the game is to fire a bullet from the ground and hit a circular target suspended in air (in a 2-dimensional space). The target is a circle of radius R, positioned at a random place, (*xt, yt)*, in the spatial unity quadrant. The bullet is a single sizeless point.

The user needs to guess and input the shooting angle, $a_0$, and the initial velocity, $v_0$, of the bullet, in order to hit the target.




Write a function*, Shootbullet*, that receives the shooting angle, the initial velocity and the information about the target, i.e. *xt, yt* and *R*. The function must return the consequent shooting trajectory, i.e. two lists, *x* and *y*, coordinates of the trajectory, as described by:

$$y = xtan(a_0) - \frac{1}{2}\frac{x^2 g}{v_0^2}\frac{1}{cos^2(a_0)}$$

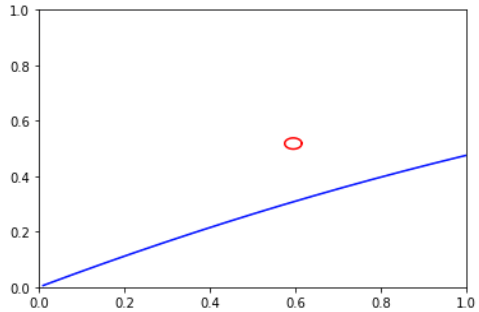
where $g = 9.81\ m/s^2$ is the gravitational constant.

Set the step of the x-axis to *dx* = 0.01.

The function must also return a Boolean variable indicating whether the bullet has hit the target or reached the ground after missing the target.

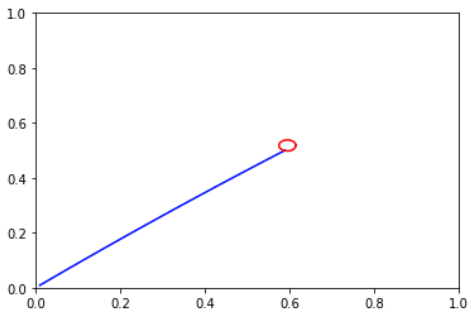
Now that you are ready to play, write a script that creates the target and asks the user to play until the target is hit. For every attempt, plot the war scenery (i.e. the trajectory and the target).

```
Shooting angle (in degree):30
Initial speed:8
```




```
You missed the target lol. Try again
```

```
Shooting angle (in degree):42
Initial speed:10
```




```
Well done: target centred. Enrol to the Army
```

**Answer Quiz 4**