ITI1120
Lab #4

List and loops in lists

Laboratory Objectives

Exercises with:

- Variables of type list
- Loops in lists

Note: Visualize the execution of your Python code at:

http://www.pythontutor.com/visualize.html#mode=edit

(choose Python 3)

Lists in Python

```
list1 = [10,20,30,40,50]
>>> list1[0]
10
>>> list1[1]
20
>>> list1[4]
50
>>> len(list1)
5
>>> type(list1)
<class 'list'>
>>> list2 = ['abc', 'xxx', 'oui']
```

Reading a list from the keyboard

- The association of functions eval() et list() enable us to convert to list any chain whose values are separated by commas.

```
ch = input('Please enter a list of values
separated by commas: ')
l1 = list(eval(ch))
print (l1)
```

Exercise 1: The average

- Develop an algorithm that computes the average of a list of elements. Implement your algorithm in Python as a function.

- Develop a program that gets a list of values from the user, calls the l'algorithm/function and computes the average and prints the results.

Exercise 2 – Statistics calculations

- Develop a software that gets a list of students' marks and find: the average, the maximum, and minimum mark.

  - The main program bloc gets students' marks from the user (stored in a list) and calls a function to get the average, the maximum and minimum values. It also displays the results to the user.

  - The function receives a list and obtains the average, minimum and maximum. The result returned is a list with three values.

Exercise 3: Ball Toss

- Derive an algorithm/function in Python that will calculate the distance (horizontal, in meters) traveled by a ball tossed at v meters per second, according to the angle θ (in degres) of the toss.
- Return a list of values where:

  distance[0]: ball tossed at 0 degres above the horizontal.

  distance[1]: ball tossed at 10 degres above the horizontal.

  ...

  distance[9]: ball tossed at 90 degres above the horizontal. (directly upward).

- Complete the main bloc of your program: call the function to create a list as described above and display the contents.

Exercise 3: Ball toss
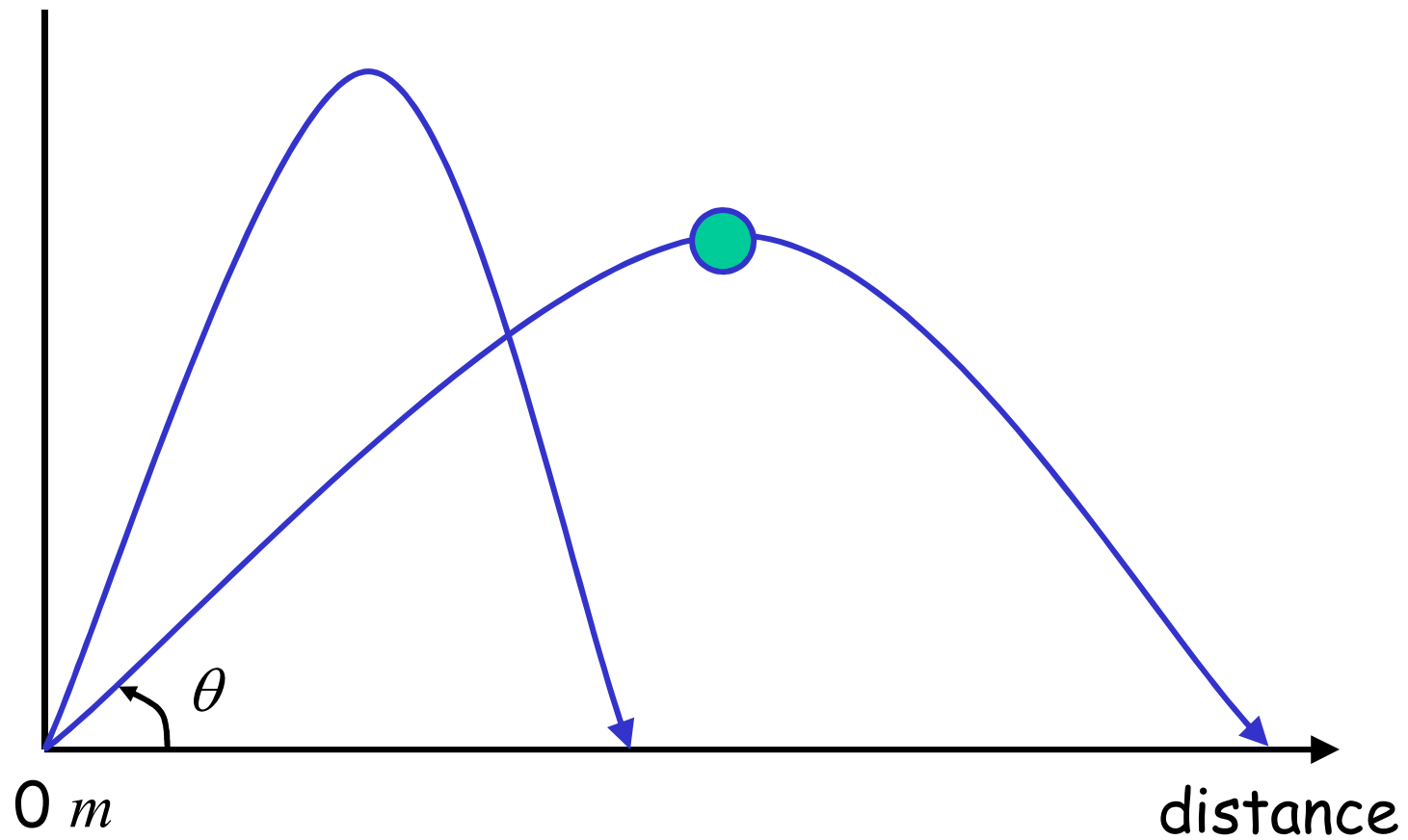
Exercise 3: Ball Toss

- Formula:

$$distance = \frac{2v^2 \cos\theta_r \sin\theta_r}{g}$$

θ_r = angle in radians

where:

$$\theta_r = \frac{\pi}{180}\theta$$

$g = 9.8$ is the constant of the universal gravity.

Exercise 3: Ball Toss

- Import the math library

    - for the value of π (`math.pi`).

    – **for `math.sin(x)`**: sinus of **x**, where **x** is in radians

    – **for `math.cos(x)`**: cosinus of **x**, where **x** is in radians

Exercise 4: Standard Deviation

- The standard-Deviation of a value is a measurement used in statistics to indicate in what conditions those values diverge from their average.

- For example, the class average is 73/100. If everyone has received 73 (which is not likely), then the standard deviation is zero. A more typical standard deviation could be 13.75.

Standard Deviation

- Suppose a set of n values represented by $\{x_i\}$ where: $0 \le i < n$.

- The standard deviation s is calculated with the formula:

$$s = \sqrt{\frac{(x_0 - a)^2 + (x_1 - a)^2 + \cdots + (x_{n-1} - a)^2}{n - 1}}$$

where

$$a = \frac{x_0 + x_1 + \cdots + x_{n-1}}{n}$$

is the average of the values.

Software: Standard Deviation

- Derive an algorithm/function in Python that computes the standard deviation of a list numbers x.

- Develop the main program bloc that gets from the user a list of values; calls the function to computse the standard deviation of the values, and displays the results.