Lab 1

COMP9021, Session 2, 2016

If you have not done so already, create two sequences of directories,

- `~/COMP9021/Labs` and
- `~/COMP9021/Lectures`.

One way to do this is to, in your home directory, execute the Unix command

```
mkdir -p COMP9021/Labs COMP9021/Lectures
```

Download from the course's website the compressed archives

- `Lab_1.tar.gz` and
- `Lecture_1.tar.gz`,

and save them in the appropriate directories. Decompress the archives. One way to do this is to, in the directory `~/COMP9021/Labs`, execute the Unix command

```
tar xzf Lab_1.tar.gz
```

and in the directory `~/COMP9021/Lectures`, execute the Unix command

```
tar xzf Lecture_1.tar.gz
```

This will create a subdirectory `Lab_1` of `~/COMP9021/Labs` and a subdirectory `Lecture_1` of `~/COMP9021/Lectures`, each of which will contain the provided material. The archives can then be deleted. One way to do this is, in the directory `~/COMP9021`, execute the Unix command

```
rm Labs/*gz Lectures/*gz
```

You will do the same for the following labs and lectures; recall then to refer to these instructions if needed.

1 Running python code

Experiment with the different ways of running python code as described in the pdf document `Running python code.pdf`, which is part of the material for the first lecture.

2 Text-based programs

Run and study the program named fahrenheit_to_celsius.py. Then write a program named celsius_to_fahrenheit.py that displays a conversion table from Celsius degrees to Fahrenheit degrees, with the former ranging from 0 to 100 in steps of 10.

Run and study the program max_in_list.py. Then write a program span.py that generates a list of 10 random integers between -50 and 50 (included), prints out the list, computes the difference between the largest and smallest values in the list, and prints it out. Here is a possible interaction:

```
$ python3 span.py
The list is: [-32, 39, 18, -17, 40, 18, 30, 44, -42, 23]
  The maximum difference between largest and smallest values in this list is: 86
Confirming with builtin operations: 86
$ python3 span.py
The list is: [3, 1, 47, -47, 10, 42, -23, 42, 24, 6]
  The maximum difference between largest and smallest values in this list is: 94
Confirming with builtin operations: 94
```

The operators /, // and % are used for floating point division, integer division, and remainder, respectively. Run and study the program named modulo_4.py. Then write a program named intervals.py that prompts the user for a strictly positive integer N, generates a list of N random integers between 0 and 19, prints out the list, computes the number of elements strictly less 5, 10, 15 and 20, and prints those out. Here is a possible interaction:

```
$ python3 intervals.py
How many elements do you want to generate? 1
The list is: [9]
 There is 0 element between 0 and 4.
 There is 1 element between 5 and 9.
 There is 0 element between 10 and 14.
 There is 0 element between 15 and 19.
$ python3 intervals.py
How many elements do you want to generate? 3
The list is: [19, 15, 18]
 There is 0 element between 0 and 4.
 There is 0 element between 5 and 9.
 There is 0 element between 10 and 14.
 There are 3 elements between 15 and 19.
$ python3 intervals.py
How many elements do you want to generate? 14
The list is: [19, 2, 8, 15, 11, 18, 15, 1, 16, 16, 0, 19, 10, 4]
 There are 4 elements between 0 and 4.
 There is 1 element between 5 and 9.
 There are 2 elements between 10 and 14.
 There are 7 elements between 15 and 19.
```

Write a program named mean_median_standard_deviation.py that prompts the user for a strictly positive integer N, generates a list of N random integers between -50 and 50 (included), prints out the list, computes the mean, the median and the standard deviation, and prints them out. Here is a possible interaction:

```
$ python3 mean_median_standard_deviation.py
How many elements do you want to generate? 1
The list is: [29]
  The mean is 29.00.
  The median is 29.00.
  The standard deviation is 0.00.
Confirming with functions from the statistics module:
  The mean is 29.00.
  The median is 29.00.
  The standard deviation is 0.00.
$ python3 mean_median_standard_deviation.py
How many elements do you want to generate? 8
The list is: [-37, -12, 18, -15, -35, -33, -45, 10]
  The mean is -18.62.
  The median is -24.00.
  The standard deviation is 21.58.
Confirming with functions from the statistics module:
  The mean is -18.62.
  The median is -24.00.
  The standard deviation is 21.58.
$ python3 mean_median_standard_deviation.py
How many elements do you want to generate? 13
The list is: [-15, 23, 29, 5, -1, 45, 22, 1, 47, -30, 32, -50, -38]
  The mean is 5.38.
  The median is 5.00.
  The standard deviation is 30.17.
Confirming with functions from the statistics module:
  The mean is 5.38.
  The median is 5.00.
  The standard deviation is 30.17.
```

Note that the statistics module is available in python 3.5, but not in python 3.2, hence the second part of the output is for a version of your program meant to be run on your own computer, not on the School machines…

To compute the median, the easiest way is to first sort the list; find out how (either excuting help(list) at the python prompt, or making a Google search).

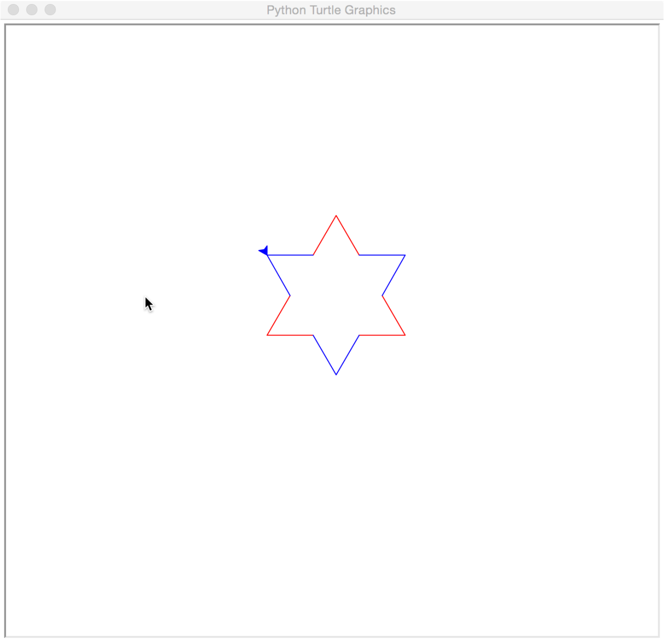
3 Drawing pictures with `turtle`

For the following exercises, you can refer to the Turtle graphics documentation, but you can complete the exercises by just studying the sample programs.

3.1 An hexagram

Run and study the program `dodecagrams.py`.

Then write a program `hexagram.py` that draws an hexagram that is centred horizontally in the window that displays it, with the colour of the tips alternating red and blue:

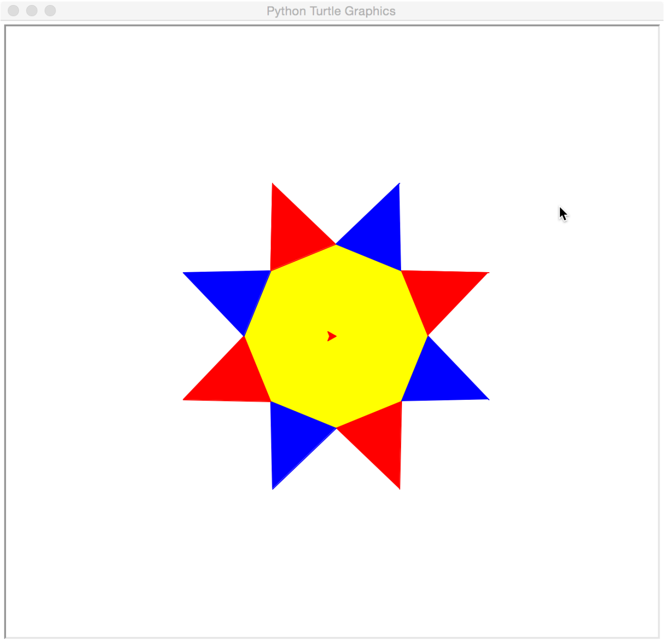


You are encouraged to draw the red part and then the blue part of the star.

3.2 An octagram

Run and study the program dodecagon.py.

Then write a program octagram.py that draws an octagram, the inscribed octagon being coloured yellow, and the colour of the triangles alternating red and blue:



You can set the distance from the centre to an edge of the inscribed octagon to 100 pixels, and the distance from the centre to the tip of a triangle to 180 pixels.