CSE101

DUE MAR. 29

23:59 KST

ASSIGNMENT I

PROFESSOR
FRANCOIS
RAMEAU

ALGEBRAIC OPERATIONS & FUNCTIONS

General instructions

- Please add your name and email in the dedicated location at the top of your code
- Do not use any external library, except when explicitly requested
- Try to follow the naming convention proposed by PEP-8 seen in class
- Use meaningful name for your variables and functions
- If you face problem submitting your code via GitHub please contact the professor and the TA by email
- Note that the received code will be tested on a classifier to detect potential usage of Large Language Model. We will also pay a particular attention to plagiarism
- Leave comments in your code to explain your code and describe the difficulties you faced

INVITATION LINK

https://classroom.github.com/a/yT3cH-TF

Exercise 1: Convert Fahrenheit to Celsius (2 points)

You will write a function `fahrenheit2celsius` that inputs a temperature in degree Fahrenheit and convert it to Celsius. The equation to convert Celsius to Fahrenheit is the following:

$$C = \frac{5}{9}(F - 32)$$

Then you will create another function called `what_to_wear` which inputs the temperature in Celsius and display to the user what to wear. Will this function be fruitful or void?

Temperature	Under -10 °C	Between -10 °C and 0	Between 0 °C and 10 °C	Between 10 °C and 20 °C	More than 20 °C
Clothe	Puffy jacket	Scarf	Sweater	Light jacket	T-shirt

Make sure that your code is working for any case (for instance if the temperature is exactly equal to 20 it should still display something)

Recap

1. Create a function `fahrenheit2celsius` 1 point
2. Create a function `what_to_wear` 1 point

Exercise 2: Area and perimeter of a triangle (4 points)

In this exercise we would like to compute the area and perimeter of a triangle given only the position of its three vertices denoted respectively $p_1 = (x_1, y_1)$, $p_2 = (x_2, y_2)$, $p_3 = (x_3, y_3)$

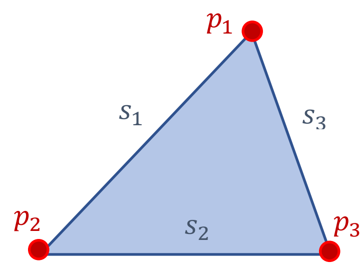

Figure 1. Depiction of the triangle and its 3 vertices

1. Compute the area of the triangle

To compute the area A of this triangle from its vertex's coordinates, we will utilize the Shoelace formula:

$$A = \left| \frac{(x_1 y_2 + x_2 y_3 + x_3 y_1) - (x_1 y_3 + x_2 y_1 + x_3 y_2)}{2} \right|$$

You will implement it in a function called `shoelace_triangle_area` you have to guess what would be the inputs and output of the function (and what will be their type of data). As a reminder, the absolute value can be computed with the function `abs()` in Python.

2. Compute the perimeter of the triangle

Computing the perimeter P of a triangle is trivial when knowing the size of each of its side s_1, s_2, s_3

$$P = s_1 + s_2 + s_3$$

To compute these lengths, you can use the Euclidean distance between the pairs of vertices. The Euclidean distance d between two points p_1 and p_2

$$d = dist(p_1, p_2) = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

Create a function `euclidean_distance` to compute the distance between two points. Then, create a function, `compute_triangle_perimeter` taking full advantage of your Euclidean distance function.

Recap

1. Create a function `shoelace_triangle_area` 1 point
2. Create a function `euclidean_distance` 1 point
3. Create a function `compute_triangle_perimeter` 2 points

Exercise 3 - Compute the area of a regular polygon

In this exercise, we will calculate the area of a regular polygon with n sides. A regular polygon is an n-sided polygon in which the sides are all the same length and are symmetrically placed about a common center. For instance, a regular polygon can be a triangle, a square, a pentagon, etc. More can be seen in Figure 2.

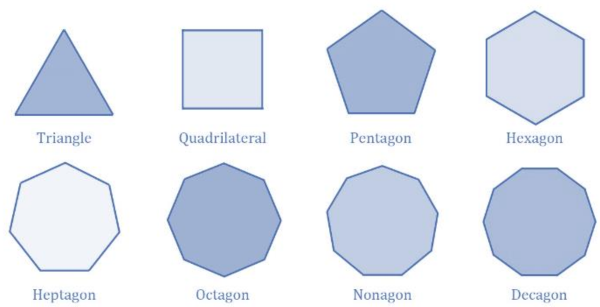

Figure 2. Different types of regular polygons

While you are very familiar with the calculation of the area of a square or of a triangle. The general formula to estimate the area A of a regular polygon is slightly more complex:

$$A = \frac{n \times s \times a}{2},$$

Where n is the number of sides, s is the length of each side, and a is the **apothem.** The apothem is the distance from the center of the polygon to the midpoint of a side.

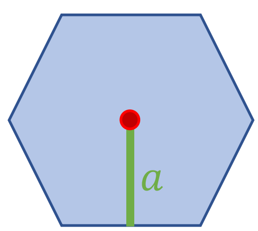

Figure 3. apothem of a hexagon

The formula to calculate the apothem is the following:

$$a = \frac{s}{2 \tan\left(\frac{180}{n}\right)}$$

You have to create a function `apothem` performing this calculation. You can import the Python module "math" to perform the tangent computation, but it is the only external function allowed in this assignment.

Be particularly careful when you use an external function! Should the input of the function `tan`() be in radian or degree? You need to verify it from online documentations or experiments. You will have to create the function `deg2rad` to convert degree to radian yourself (you can also use the value of pi from the `math` module of python).

With the support of your previous functions, create a function `polygon_area` to compute the area of a regular polygon from the number of side and their length.

Here are the steps you will have to resolve for this exercise:

Recap

1.	Create a function `deg2rad` to convert radian to degree	1 point
2.	Fill the function `apothem` appropriately (you might use the previous function inside)	1 point
3.	Fill the function `polygon_area` using the appropriated functions you have developed before	2 points