Problem Set 8 - Functions

Hello students,

the goal of this problem-set is to start using functions.

As you saw in the lectures, functions allow you to write pieces of code that can be called multiple times from a program.

Assignment 8.1 - Operations on tridimensional vectors (3 points)

Develop a program containing some functions/procedures allowing you to perform some basic operations on tridimensional vectors.

The functions you must create will allow the user to:

- create a tridimensional vector;
- initialize a tridimensional vector with random coordinates x, y, z (it should be possible to provide *min_value* and *max_value* for the random);
- print a vector (see example for formatting);
- sum two vectors, returning a new one;
- multiply a vector and a constant, returning a new vector;
- cross product (vectorial product) between two vectors (https://en.wikipedia.org/wiki/Cross_product), returning a new vector.

In the main function you must use the function you wrote to test they work. An example of a possible output of the main is:

```
v0 = (8, 11, 9)
v1 = (5, -2, 0)

v0 + v1 = (13, 9, 9)

6 * v0 = (48, 66, 54)

v0 x v1 = (18, 45, -71)
```

Hint: A useful function to generate random ints in a range is randint.
You can import the function as follows:

```
from random import randint
```

Assignment 8.2 - BMI (6 points)

The BMI, or Body Mass Index, is a measurement to approximate the quantity of fat present in someone's body, based on weight and height.

The formula to calculate it is: $BMI = \frac{weight(kg)}{height^2(m^2)}$

The result can be confronted with the following table:

- Underweight: < 18.5
- Normal weight: 18.5 – 24.9
- Overweight: 2 5– 29.9
- Obesity: >= 30 or greater

For example Mr. Muster weights 80kg and is 1.8m tall, so his BMI will be calculated as follows:

$BMI = \frac{80}{1.8^2} = 24.7$

Referencing the aforementioned list, it is considered a normal body weight.

A recent survey performed by the Sanity Union Professional Safety International association has generated a huge dataset of data, regarding users.
Your job as a professional data-scientist is to extrapolate meaningful data.

Your boss Reginald Osborn Bright needs the following functions to elaborate the dataset:

- get the BMI for each person: given the people list, return a new list also containing the BMI
- get the person with the highest BMI: given the people list, return a new dictionary representing the person and adding the BMI
- get the person with the lowest BMI: given the people list, return a new dictionary representing the person and adding the BMI
- calculate the average BMI: given the people list, return a float containing the average BMI
- calculate the average BMI per males: given the people list, return a float containing the average BMI
- calculate the average BMI per females: given the people list, return a float containing the average BMI
- present in a pretty way an entry

All calculated BMIs must be rounded to 2 decimals

Write a main to show your work, as shown in the example on the next page, using the provided dataset.

Main output example:

```
Fist 5 average BMIs:
name: Sarah Taylor, height: 1.88, weight: 52, gender: female, bmi: 14.71
name: Daniel Mitchell, height: 1.53, weight: 45, gender: male, bmi: 19.22
name: Jess Rodriguez, height: 1.55, weight: 57, gender: female, bmi: 23.73
name: Lisa Moore, height: 1.64, weight: 95, gender: female, bmi: 35.32
name: Robert Martinez, height: 1.64, weight: 72, gender: male, bmi: 26.77

Person with highest BMI
name: Jennifer Wright, height: 1.62, weight: 107, gender: female, bmi: 40.77

Person with lowest BMI
name: Michael Hernandez, height: 1.92, weight: 47, gender: male, bmi: 12.75

Average BMI: 25.16
Average male BMI: 23.84
Average female BMI: 26.48
```

You are provided an extract from the dataset to develop the functions:

```
people = [
    {"name": "Sarah Taylor", "height": 1.88, "weight": 52, "gender": "female"},
    {"name": "Daniel Mitchell", "height": 1.53, "weight": 45, "gender": "male"},
    {"name": "Jess Rodriguez", "height": 1.55, "weight": 57, "gender": "female"},
    {"name": "Lisa Moore", "height": 1.64, "weight": 95, "gender": "female"},
    {"name": "Robert Martinez", "height": 1.64, "weight": 72, "gender": "male"},
    {"name": "Patricia White", "height": 1.79, "weight": 80, "gender": "female"},
    {"name": "Carol Thomas", "height": 1.68, "weight": 96, "gender": "female"},
    {"name": "Andrew Hill", "height": 1.77, "weight": 69, "gender": "male"},
    {"name": "Carol Allen", "height": 1.76, "weight": 85, "gender": "female"},
    {"name": "Edward Mitchell", "height": 1.77, "weight": 59, "gender": "male"},
    {"name": "Andrew Robinson", "height": 1.69, "weight": 102, "gender": "male"},
    {"name": "Edward Robinson", "height": 1.64, "weight": 57, "gender": "male"},
    {"name": "Andrew Nelson", "height": 1.8, "weight": 102, "gender": "male"},
    {"name": "James Robinson", "height": 1.75, "weight": 67, "gender": "male"},
    {"name": "Ashley Nelson", "height": 1.7, "weight": 67, "gender": "female"},
    {"name": "Brian Roberts", "height": 1.82, "weight": 101, "gender": "male"},
    {"name": "Jennifer Wright", "height": 1.62, "weight": 107, "gender": "female"},
    {"name": "George Lee", "height": 1.76, "weight": 79, "gender": "male"},
    {"name": "Donna Perez", "height": 1.79, "weight": 73, "gender": "female"},
    {"name": "Emily Brown", "height": 1.92, "weight": 56, "gender": "female"},
    {"name": "Michael Hernandez", "height": 1.92, "weight": 47, "gender": "male"},
    {"name": "George Martin", "height": 1.78, "weight": 67, "gender": "male"},
    {"name": "Jess Mitchell", "height": 1.76, "weight": 76, "gender": "female"},
    {"name": "Sarah Lewis", "height": 1.55, "weight": 88, "gender": "female"},
    {"name": "Sandra Clark", "height": 1.51, "weight": 82, "gender": "female"},
    {"name": "Brian Rivera", "height": 1.7, "weight": 66, "gender": "male"},
    {"name": "Sandra Williams", "height": 1.8, "weight": 71, "gender": "female"},
    {"name": "Mary Roberts", "height": 1.91, "weight": 73, "gender": "female"},
    {"name": "Mary Harris", "height": 1.62, "weight": 72, "gender": "female"},
    {"name": "Edward Davis", "height": 1.53, "weight": 89, "gender": "male"},
    {"name": "Jess Williams", "height": 1.73, "weight": 71, "gender": "female"},
    {"name": "Brian Perez", "height": 1.86, "weight": 70, "gender": "male"},
    {"name": "Matthew Scott", "height": 1.64, "weight": 72, "gender": "male"},
    {"name": "Robert Lopez", "height": 1.66, "weight": 47, "gender": "male"},
    {"name": "John Flores", "height": 1.72, "weight": 60, "gender": "male"},
    {"name": "Patricia Adams", "height": 1.78, "weight": 71, "gender": "female"},
    {"name": "Emily Jones", "height": 1.58, "weight": 85, "gender": "female"},
    {"name": "James King", "height": 1.91, "weight": 59, "gender": "male"},
    {"name": "Margaret Allen", "height": 1.68, "weight": 59, "gender": "female"},
    {"name": "George Nguyen", "height": 1.79, "weight": 91, "gender": "male"},
]
```

Assignment 8.3 - Rock paper scissors (optional)

Develop a software that makes you play "Rock Paper Scissors" against the PC.

The user will specify the number of games to be played.
For each game the user must input its entry, which must be validated, and the PC generates its move randomly.
In case it is a tie, the game is not considered (not counted).
After all the games have been played, the program must show the statistics and the percentage of winning for each player.

Example output:

```
How many matches do you want to play? 3

Game 0
---
Insert your entry: lizard
Invalid entry, please insert a valid entry: scissors
Tie! Both players played 'scissors'
Insert your entry: rock
pc plays: scissors
USER WINS!

Game 1
---
Insert your entry: paper
Tie! Both players played 'paper'
Insert your entry: rock
pc plays: paper
PC WINS!

Game 2
---
Insert your entry: paper
pc plays: rock
USER WINS!


---
The overall winner is: USER!
User won 2 time(s), on average 66.67%
PC won 1 time(s): , on average 33.33%
```