COMPUTER SCIENCES, 2021/2022

Laboratory 1

Main objectives

- To acquire confidence with the Python IDE (Integrated Development Environment)
- To acquire confidence with the Python language

Technical contents

- Use of the several programming tools
- Creating and running Python scripts
- Use of print function in the command line

Preferably to be solved in the laboratory session

Esercizio 1. The proposed program stores two integers as two **constants** defined inside the code, and then display:

i. Their sum
ii. Their difference
iii. Their product
iv. Their average value
v. Their distance (i.e. the absolute value of the difference)
vi. The maximum value (i.e. the greater of the two)
vii. The minimum value (i.e. the lesser of the two)

Try to execute the follow code and understand as it work. Use the debug during the analysis.

```
##
#  Save two integers in two constants, and display the result of several calculations involving them.
#

NUM_1 = 20
NUM_2 = 40

# Alternatively, read the integers from the user.
# NUM_1 = int(input("Enter an integer: "))
# NUM_2 = int(input("Enter another integer: "))

# Compute and display the sum, difference, product, average, distance,
# minimum and maximum.
print("Sum:", NUM_1 + NUM_2)
print("Difference:", NUM_1 - NUM_2)
print("Product:", NUM_1 * NUM_2)
print("Average:", (NUM_1 + NUM_2) / 2)
print("Distance:", abs(NUM_1 - NUM_2))
print("Minimum:", min(NUM_1, NUM_2))
print("Maximum:", max(NUM_1, NUM_2))
```

Esercizio 2. You want to find out which fraction of your car's use is for going to work, and which is for personal use. You know the one-way distance from your home to work. For a particular period, you recorded the beginning and ending kilometers on the odometer and the number of working days. Try to execute the follow code able of computing the fraction of car's use for work and personal. Use the debug during the analysis. [R1.16]

```
km_start = int(input("insert beginning kilometers: "))
km_stop = int(input("insert ending kilometers: "))
working_days = int(input("insert the number of working days: "))
km_home_work = int(input("insert the home-work discance: "))

km_total = km_stop - km_start
km_work = working_days * (km_home_work *2)
km_not_work = km_total - km_work

km_work = 100 * (km_work/km_total)
km_not_work = 100 * (km_not_work/km_total)

print(10*"-")
print(f"car used for work activities: {km_work:3.2f} %")
print(f"car used for not work activities: {km_not_work:3.2f} %")
```

Esercizio 3. Imagine that you and a number (M) of friends go to a luxury restaurant, and when you ask for the bill, you want to split the total amount and the tip (15 percent) between all. Your program should print the amount of the bill, the tip, the total cost, and the amount each person has to pay. It should also print how much of what each person pays is for the bill and for the tip. Try to execute the follow code and understand as it work. Use the debug during the analysis. [R1.20]

```
friend_number = int(input("insert the number of friends: "))
total_amount  = int(input("insert the total amount [€]: "))

total_tip = total_amount * 0.15
tip = total_tip / friend_number
amount = total_amount / friend_number

amount_per_friend = tip + amount
final_amount = total_amount + total_tip

print(15*'-')
print("GLOBAL INFORMATION")
print(f"The total tip is {total_tip} €")
print(f"The final amount is {final_amount} €")
print(15*'-')
print("INFORMATION PER FRIEND")
print(f"The final amount per friend is {amount_per_friend} €")
print(f"The tip for each friend is {tip} €")
print(f"The amount without the tip is {amount} €")
```

Esercizio 4. Write a program that prints the sum of the first ten positive integers, 1 + 2 + … + 10. [P1.2]

Esercizio 5. Write a program that prints the balance of an account after the first, second, and third year. The account has an initial balance of $1,000 and earns 5 percent interest per year. [P1.4]

To be solved at home

Esercizio 6. In a scheduling program, we want to check whether two appointments overlap. For simplicity, appointments start at a full hour, and we use hours in the format 0-23h. The following pseudocode describes an algorithm that determines whether the appointment with start time *start1* and end time *end1* overlaps with the appointment with start time *start2* and end time *end2*.

```
If start1 > start2
   s = start1
Else
   s = start2
If end1 < end2
   e = end1
Else
   e = end2
If s < e
   The appointments overlap.
Else
   The appointments don't overlap.
```

1. Trace this algorithm with an appointment from 10–12 and one from 11–13, then with an appointment from 10–11 and one from 12–13.
2. Draw a flowchart for the algorithm.
3. Explain the algorithm functionality and verify if it is correct [R3.12]

Esercizio 7. The following algorithm yields the season (Spring, Summer, Fall, or Winter) for a given month and day.

```
If month is 1, 2, or 3, season = "Winter"
Else if month is 4, 5, or 6, season = "Spring"
Else if month is 7, 8, or 9, season = "Summer"
Else if month is 10, 11, or 12, season = "Fall"
         If month is divisible by 3 and day >= 21
If season is "Winter", season = "Spring"
Else if season is "Spring", season = "Summer"
Else if season is "Summer", season = "Fall"
Else season = "Winter"
```

Draw a flowchart for the algorithm. Please verity if the algorithm behaves correctly using series of test inputs [R3.13]

Esercizio 8. Please consider the following mathematical algorithm:

Given a value α > 0, a common method to calculate the square root (√α) is based on the Babylonian approximation algorithm, which employs the same principles of the Newton method. This algorithm performs the following steps:

1. Put **n** (integer) = 1 and start with an arbitrary positive value **X_n** (when **X_n** is closer to the square root value, the better the convergence of the algorithm)
2. Replace **X_n** with the average between **X_n** and (α / **X_n**)
3. Increase **n** and repeat step 2

This algorithm can be represented as:

$$X_{n+1} = \frac{1}{2}\left(X_n + \frac{\alpha}{X_n}\right)$$

From which is derived:

$$\lim_{n\to\infty} \sqrt{\alpha}$$

Please, draw the flow chart for this algorithm and try to run it step by step to calculate √3.

Esercizio 9. The ability to speak more than one language is a valuable skill in today's labor market. One of the basic skills is learning to greet people. Write a program that prints a two-column list with the greeting phrases shown in the following table; in the first column, print the phrase in English. In the second column, print the phrase in Italian. Please, find a way to align both columns. [P1.16]

List of Phrases to Translate
Good morning.
It is a pleasure to meet you.
Please call me tomorrow.
Have a nice day!
Hi, how are you?
How is it going?

Esercizio 10. Write a programs that displays your name inside a box on the screen, like:

```
+---------+         +-------+
¦ WILLIAM ¦         ¦   W   ¦
+---------+         ¦   I   ¦
                    ¦   L   ¦
                    ¦   L   ¦
                    ¦   I   ¦
                    ¦   A   ¦
                    ¦   M   ¦
                    +-------+
```

Do your best to approximate lines with characters such as “ | ” ,“ - ”, “ + ”, “ . ”, “ ¦ ”. [P1.5]