

WORK NOTEBOOK - TECHNOLOGY & ENGINEERING

TOPIC 5. PROGRAMMING

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5.1. INTRODUCTION

1. In order to practice mathematical operators, the following calculations are proposed:

a.
$$\frac{3 \cdot 2 + 7}{8 + 9 \cdot 4} \cdot 7 + \left(\frac{2 + 5 \cdot 6}{3 \cdot 5 + 9} \right)^2$$

b.
$$\frac{3 \cdot (2 + 7)}{(8 + 9) \cdot 4} \cdot 7 + \left(\frac{(2 + 5) \cdot 6}{3 \cdot (5 + 9)} \right)^2$$

c.
$$\frac{3 \cdot 2 + 7}{8 + 9 \cdot 4} \cdot \left[7 + \left(\frac{2 + 5 \cdot 6}{3 \cdot 5 + 9} \right)^2 \right]$$

Results: a) 3.845959595959596; b) 3.7794117647058822; c) 2.593434343434344

2. In order to practice mathematical operators, the following calculations are proposed:

a. $\cos(\pi/6) + \sin(\pi/6)$

b. $\ln(4.5)$

c. $\ln|4-9|$

d. $\log 1000$

e. $\log 0.00001$

f. $\log_3 81$

g. $\cos(150)$

h. $\tan(135)$

i. For $\theta = 30^\circ$, calculate: $\sqrt{2 + \sqrt{2 + 2\cos 4\theta}}$

j. For $x = 60^\circ$, calculate: $(\cos^2 x - 4\sin x + 6)(1 - \sin x)$

k. $\tan \left(2 \arctan \left(\frac{1}{5} \right) - \frac{\pi}{4} \right)$

l. For $\alpha = 45^\circ$, calculate: $4 \sin^2 x + 3 \cos^2 x + \sin x/2 + \cos x/2$

a)1.3660254037844386 b)1.5040773967762742 c)1.6094379124341003 d)3 e)-5 f)4.0
g)-0.8660254037844387 h)-1.0000000000000002 i)1.7320508075688772 j)0.37323961120950405
k)-0.41176470588235287 l) 4.8065629648763775

5.2. VARIABLES AND CHARACTER STRINGS

3. Print your first 8 family names, each in a different line.
4. Print a list (in a different line for each result) of the character number (length) of your 8 first family names.
5. Print the following sentence:

c:\filename\name\orion\alpha\neo.pdf

6. In order to practice *input* function, the following program is proposed:

Library index:

In this exercise, you must create a program that asks the user for information: age, gender, birthplace, occupation, passions and hobbies, or any other information. After it, using this information, the program must display the biography or library index of the user on the screen.

7. Calculation of vertical throw:
In this exercise, you must create a program that asks the user for the vertical throw data (initial speed and initial height). After it, the program must calculate and display the maximum height of the object and the time required to return to the point of projection on the screen, all together in a single sentence. It must be able to use float data type, and the result will have 2 decimal digits.
8. Surface area of a closed cylinder:
In this exercise, you must create a program that, after asking the user for the values of radius and heights, calculates the surface area of a closed cylinder and displays it on the screen in a sentence.
9. Calculation of the profit:
In this exercise, you must create a program that calculates the profit that would make a person when depositing money into his checking account. For that, the program must ask the user for the amount of money to deposit, how many years will it remain in the account and the profitability offered by the bank. Then, the program must calculate and display the profit and the final amount of money on the screen.

5.3. WHILE STATEMENT

10. In order to practice *while* statement, the following program is proposed:
List of square numbers:
In this exercise, you must create a program that calculates and displays the first 30 square numbers on the screen in a sentence: "the square of x is y".

11. In order to practice *while* statement, the following program is proposed:
Ask the user for a number, trying to guess your age. While the user doesn't guess the number, keep asking, stating an error message. When the user guesses the number, display a congratulations message.

5.4. IF STATEMENT

12. Surface area of a closed cylinder 2:
In a second version of this program, units must be taken into account. The program must accept values to be entered in different units (metres or millimetres) and it will calculate the surface area correctly in any situation.
13. In this exercise, you must create a program that asks the user for his height. If it is less than 1.50m, the program will say that this height belongs to the *short people* tercil; if it is between 1.50m and 1.80m, the height will belong to *average people* tercil; and finally, if it is greater than 1.80m, the height will belong to *tall people* tercil. The program must display the answer on the screen.
14. Who is younger?:
In this exercise, you must create a program that asks the user for the age of three people. For that, it must ask first for their names. Then, the program will decide who is younger and who is older, and it will display the result on the screen. You must take into account that two people can be the same age.

As a clue, you must know that there are 13 different possible combinations with respect to the age of three people.

15. hp-kW converter:
In this exercise, you must create a program that converts between horsepower (hp) and kilowatts (kW). For that, it will firstly ask the user for the conversion to do: (1) from hp to kW or (2) from kW to hp. Then, it will ask the value to be converted, and finally, it will display the converted result on the screen.

Loops (While & IF commands)

16. Calculation of the mean value:
In this exercise, you must create a program that calculates the average of a set of numbers. For that, it will firstly ask the user for how many values are to be introduced. Secondly, it will ask each value one by one. Finally, it will calculate the mean of the set of numbers and display it on the screen.
17. Calculate and list all prime numbers enclosed between 100 and 1000, and print a sentence about it.

18. Ask for a number between 30 and 60.
- If the number is not in that range, return an error message.
 - If the number is in that range, print a list between 30 and that number.
19. Ask for a word, and then:
- Measure the length of the word in characters.
 - Measure the length of your family name.
 - Print the maximum and minimum value of both numbers using a sentence for that.
 - List all integer numbers in that range.
20. Calculation of the profit 2:
In this exercise, you must improve the previous program. In this case, the profitability can change from year to year. This new program must also calculate the profit and the final amount of money.
21. Money itemisation:
In this exercise, you must create a program that, after asking for an amount of money in euros, itemises this amount in bills and coins. We have bills of 500€, 200€, 100€, 50€, 20€, 10€ and 5€, and coins of 2€, 1€, 0.50€, 0.20€, 0.10€, 0.05€, 0.02€ and 0.01€.

In order to work correctly, after subtracting decimal numbers, the result must be rounded to 2 decimal digits.

Indexing

22. Find the vowels:
In this exercise, you must create a program that asks the user for a word. Then, it will display the vowels appearing in that word and their corresponding position. Take accent marks into account.
23. Find the digit:
In this exercise, you must create a program that asks the user for a number (in order to simplify it, the number will be an integer). Then, it will ask for a digit and will count how many times this digit appears in the number.

For example:

```
Insert a number: 65921736382392725382625
Which digit do you want to find? 3
In number 65921736382392725382625 appears 4 times digit 3
```

24. Find the letter:
You must create a program that asks the user for a word (in order to simplify it, the word will be in lowercase and with no accent mark). Then, it will ask for a letter and will count how many times this letter appears in the word.

For example:

```
Write a word: supercalifragilisticexpialidocious
Which letter do you want to find? s
In word supercalifragilisticexpialidocious appears 3 times letter s
```

Mixed exercises

25. Multiple choice questions:

In this exercise, you must design a test of 7 multiple choice questions (a, b or c). To start with, the user must write "START", and it will continue to the next question only when the answer is correct. When finishing the test, the program will tell in which attempt has each question been answered correctly.

26. Find the vowels 2:

In this exercise, you must create a program that asks the user for a sentence. Then, it will display the vowels appearing in that sentence and which word they belong to. Take accent marks into account.

27. Palindromic numbers:

In this exercise, you must create a program that asks the user for a number and checks whether the number is a palindrome or not.

A palindromic number is a number that remains the same when its digits are reversed. For example, 81418.

Functions

28. Repeat exercise 23 using functions.

29. Repeat exercise 24 using functions.

30. Repeat exercise 25 using functions.

31. Repeat exercise 26 using functions.

32. Repeat exercise 27 using functions.