Bialystok University of Technology
Faculty of Electrical Engineering
Department of Electrotechnics, Power Electronics
and Electrical Power Engineering

Instruction
for a specialist workshop on

Python Programming 1

Subject code: **CP1S02005E**

(Full-Time Studies)

PYTHON - FOR AND WHILE LOOPS

Instruction Number

PP_03_EN

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Contents

Teaching Materials for Students of the Faculty of Electrical Engineering at BUT.

1. Workstation Description

1.1. Equipment used

A PC-class computer with the Microsoft Windows 10 operating system is used during classes.

1.2. Software

The computers are equipped with the Visual Studio Code 1.86 (or newer) source code editor along with the appropriate extension (Python extension for Visual Studio Code).

2. Exercises Procedure

In the specialist workshop, selected tasks assigned by the instructor must be completed. Different groups may perform different tasks.

1. Write a program that prints the following number sequences. Use one **for** loop to print each sequence.

```
1  2  3  4  5  6  7  8  9
9  8  7  6  5  4  3  2  1
2  4  6  8  10  12  14  16
-12  -8  -4  0  4  8  12
1  2  4  8  16  32  64  128
11  9.5  8  6.5  5  3.5  2  0.5
```

2. Write a program that calculates and displays the factorial of a number **n** entered from the keyboard.

3. The dependence of a conductor's resistance on temperature is described by the following formula:

$$R_t = R_{20}\left[1 + \alpha\left(t - 20°C\right)\right]$$

where:

R_t - resistance at temperature t,

R_{20} - resistance at 20 °C,

α - temperature coefficient of resistance, $^oC^{-1}$.

A copper conductor (α **= 4.3·10^{-3}**) has a resistance of **R_{20} = 10 Ω** at **t = 20 ºC**. Write a program that calculates and prints the resistance of this conductor at temperature ranging from **0 ºC** to **200 ºC** in steps of **20 ºC**.

Example of program execution:

```
  0 [C] -->  9.14 [Ohm]
 20 [C] --> 10.00 [Ohm]
 40 [C] --> 10.86 [Ohm]
 60 [C] --> 11.72 [Ohm]
 80 [C] --> 12.58 [Ohm]
100 [C] --> 13.44 [Ohm]
120 [C] --> 14.30 [Ohm]
140 [C] --> 15.16 [Ohm]
160 [C] --> 16.02 [Ohm]
180 [C] --> 16.88 [Ohm]
200 [C] --> 17.74 [Ohm]
```

4. Write a program that reads two integers: the lower and upper limits of a range. The program should print all numbers in this range along with their squares and cubes. Example of program execution:

```
Lower limit:  2
Upper limit:  4

2   4   8
3   9   27
4   16  64
```

5. The Fibonacci sequence is defined by the following recursive formula:

$$F_n = \begin{cases} 0 & \text{for } n = 0 \\ 1 & \text{for } n = 1 \\ F_{n-1} + F_{n-2} & \text{for } n > 1 \end{cases}$$

Write a program that calculates the value of the **nth** term of this sequence.

Example of program execution:

```
Enter n: 10
F10 = 55
```

6. Write a program that reads a floating-point number in a loop. If the number is greater than zero, the program calculates and displays its square root. If the number is less than zero, the program calculates and displays its square. If the number is zero, the program exits. Otherwise, it prompts the user for the next number.

   Example of program execution:

```
Enter a number: 3
Square root:    1.732051

Enter a number: -4
Square:         16

Enter a number: 9
Square root:    3

Enter a number: 0
END
```

7. Write a program that reads integers until the user enters zero. The program should then print the count of odd numbers entered.

   Examples of program execution:

```
Number:  3
Number:  2
Number:  -1
Number:  1
Number:  0
---------------
Odd numbers: 3
```

```
Number:  6
Number:  5
Number:  -2
Number:  -3
Number:  0
---------------
Odd numbers: 2
```

8. Write a program that reads integers until they form an increasing sequence. The program should then display the sum of all numbers in this sequence, excluding the last value.

   Examples of program execution:

```
2
4
5
8
7
---------
Sum: 19
```

```
-2
0
3
4
4
---------
Sum: 5
```

```
2
1
---------
Sum: 2
```

9. Write a program that calculates the sum of the digits of a natural number entered from the keyboard.

   Examples of program execution:

```
Number:  354
-------------
Sum:     12
```

```
Number:  3
-------------
Sum:     3
```

```
Number:  1549
-------------
Sum:     19
```

10. Write a program that calculates the number of digits in an integer entered from the keyboard.

    Examples of program execution:

```
Number:  354
--------------------
Number of digits: 3
```

```
Number:  1549
--------------------
Number of digits: 4
```

3. Literature

[1] Ramalho L., Fluent Python: clear, concise, and effective programming. Sebastopol, O'Reilly, 2022.

[2] Matthes E., Python Crash Course, San Francisco, CA, No Starch Press, 2019.

[3] Sweigart A., Automate the Boring Stuff with Python, San Francisco, CA, No Starch Press, 2020.

[4] Lutz M., Learning Python, Sebastopol, CA, O'Reilly Media, 2013.

[5] https://www.python.org/doc/ Python, documentation.

4. Health and Safety Requirements

To begin the practical part of the exercise, it is mandatory to familiarize yourself with the health and safety instructions and fire safety guidelines and to adhere to the rules contained therein.

During laboratory sessions, the following rules must be observed:

- Verify that the devices available at the laboratory workstation are complete and show no signs of physical damage.
- If possible, adjust the workstation conditions to suit individual ergonomic needs. Position the computer monitor to ensure constant and comfortable visibility for all team members.
- Check the correctness of device connections.
- The computer may only be turned on with the instructor’s permission.
- Eating and drinking are prohibited while working with the computer.
- Upon completion of work, log out before leaving the workstation. The operating system may only be shut down upon explicit instruction from the instructor.
- Making any modifications, switching components, or replacing elements of the workstation is strictly prohibited.
- Changing the computer's configuration, including the operating system and software, is not allowed unless it is part of the class program and performed under the instructor’s supervision.
- In the event of a power failure, immediately turn off all devices.
- Any missing equipment or malfunctions must be reported to the instructor.
- It is forbidden to operate, manipulate, or use devices not included in the current exercise.
- In case of electric shock, immediately disconnect the workstation from the power supply. Do not touch the affected person before the power is turned off.