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)

VISUAL STUDIO CODE PYTHON - GENERAL PROGRAM STRUCTURE, I/O OPERATIONS, VARIABLES, OPERATORS AND ARITHMETIC EXPRESSIONS

Instruction Number

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

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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 printing a visiting card on the screen.



2. Given **R** = 100 Ω and **U** = 8 V, compute and print the value of current I flowing through the resistor.

Example of program execution:

Current I [A]: 0.08

3. Direct current (I) flows through the resistor (R). Write a program that computes the voltage drop (U) across the resistor and the power (P) emitted in the resistor. The resistance (R) and current (I) values enter using **scanf()** function.

Example of program execution:

Enter R [Ohm]: 470 Enter I [A]: 0.25 ------Voltage U [V]: 117.5 Power P [W]: 29.375

Write a program that computes coefficients (a, b) of the equation (1) of the line passing through two points: (x₁,y₁) and (x₂,y₂). Coordinates of points enter using scanf() function.

$$y = ax + b \tag{1}$$

Example of program execution:

Point no. 1 x1: 0 y1: 2 Point no. 2 x2: 3 y2: 1 ------Coefficient a: -0.333333 Coefficient b: 2.000000

5. The resistance **R** of a homogeneous conductor with a cross-sectional area **S** and length **I**, made of a material with resistivity ρ , is given by the formula:

$$R = \rho \cdot \frac{l}{S} \tag{2}$$

Write a program in which the user inputs the cross-sectional area S and the length I of the conductor from the keyboard. The program should calculate and display the resistance **R** of the conductor when it is made of copper, aluminum, silver, and gold.

Material	Resistivity $[\Omega \cdot m]$
copper	1.72·10 ⁻⁸
aluminum	2.82·10 ⁻⁸
silver	1.59·10 ⁻⁸
gold	2.44·10 ⁻⁸

Table 1. Resistivity of selected materials at 20 °C

Write a program in which the user inputs the values of three resistances R₁₂, R₂₃, and R₃₁ connected in a delta (triangle) configuration. Calculate the resistances R₁, R₂ i R₃ of the equivalent star (Y) connection.



Fig. 1 Delta (Triangle) and Star (Y) Resistances

7. Write a program that calculates the resonant frequency **fr** of a circuit with resistance **R**, inductance **L**, and capacitance **C** entered from the keyboard.

	Example of progra	Equation		
a)	Resistance R [Om]: Inductance L [H]: Capacitance C [F]: Frequency fr [Hz]:	10 0.1 1.0e-6 503.54397	$f_r = \frac{1}{2\pi\sqrt{LC - (RC)^2}}$	(3)
b)	Resistance R [Om]: Inductance L [H]: Capacitance C [F]: Frequency fr [Hz]:	5000 0.02 4.0e-5 177.942413	$f_{\rm r} = \frac{1}{2\pi\sqrt{\rm LC} - \left(\frac{\rm L}{\rm R}\right)^2}$	(4)

Resistance R [Om]: 500 0.03 Inductance L [H]: $f_{r} = \frac{1}{2\pi} \sqrt{\frac{1}{LC} - \frac{1}{(RC)^{2}}}$ (5)6.0e-5 C) Capacitance C [F]: 118.508408 Frequency fr [Hz]: Resistance R [Om]: 10 1 Inductance L [H]: $f_r = \frac{1}{2\pi} \sqrt{\frac{1}{LC} - \left(\frac{R}{L}\right)}$ (6) d) Capacitance C [F]: 1.0e-6 159.146988 Frequency fr [Hz]: 100 Resistance R [Om]: 0.05 Inductance L [H]: $f_{\rm r} = \frac{1}{2\pi\sqrt{\rm LC}}\sqrt{1 - \frac{\rm L}{\rm R^2C}}$ (7)5.0e-3 e) Capacitance C [F]: _____ 10.060807 Frequency fr [Hz]:

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] <u>https://www.python.org/doc/</u> 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.