Control Structures

# Before Class

1. Find out what programming language statements are used to handle decisions and performs computations and actions conditionally.
2. Read chapter 3 "Conditional execution" from the textbook.
3. Watch the videos on using if-then-else conditional statements in Python:

<https://youtu.be/FvMPfrgGeKs?feature=shared>

<https://youtu.be/Zp5MuPOtsSY?feature=shared>

<https://youtube.com/playlist?list=PLi01XoE8jYohWFPpC17Z-wWhPOSuh8Er->

1. How, in a computer program, it is possible to execute a program statement multiple times. Familiarise yourself with loop statements (for and while).
2. Watch the video on using the "for" statement in Python:

<https://youtu.be/94UHCEmprCY>

1. Find out what the term “debugging” means. Then watch the video explaining how to test your program using the debugger.

<https://youtu.be/KEdq7gC_RTA>

<https://youtu.be/b4p-SBjHh28?feature=shared>

1. In the following program, mark breakpoints in lines 1, 5 and 7. Then, do the tasks below:
   1. Run the program in debug mode. Then, execute all program statements, one by one. Observe the changing values of variables.
   2. Run the program in debug mode. Move between the marked breakpoints.
   3. Run the program in debug mode. Add the variable ‘sum’ and ‘number’ to the Watch window, and the expression number <= 5. Execute the program step by step. Observe the changes in the variables and in the added expression.

sum = 0  
number = 1  
while number <= 5:  
 sum = sum + number  
 number = number + 1  
message = f"Sum of numbers in <1,5> is {sum}"  
print(message)

# During Class

## Conditional statement

1. The speed limit on a motorway in Poland is 140 km/h. Write a program that checks whether a car exceeded the speed limit. If so, a warning is displayed. Sample result:

Enter car speed km/h: 157  
Warning: Speed limit exceeded!!

1. A test is passed when the number of correctly completed tasks is at least 50%. Write a program that checks whether the test is passed and displays the following information:

Test passed

The total number of test tasks and the number of correctly completed tasks are included in variables.

1. Write a program to calculate the absolute value of a number entered from the keyboard. Sample result:

Enter number: -17  
|-17| = 17

1. Write a program that checks whether the number entered from the keyboard is even or odd. Sample result:

Enter number: 27  
Number is odd

1. Paul is 21 and Annie is 18. Write a program that checks that both are adults. Sample result:

paul = 21  
annie = 18  
Both are adults

1. A user enters two integer numbers from the keyboard. Write a program that checks whether at least one of them is not negative. Sample result:

Enter number 1: 25  
Enter number 2: -17  
At least one of entered numbers is not negative

## Loops

1. Write a program that displays the sentence "Practice makes perfect" five times. Use the "while" statement.
2. Write a program that displays the sentence "Practice makes perfect" five times. Use the "for" statement.
3. Write a program that calculates the sum of integer numbers in the range <1,5>. Use the "while" statement.
4. Write a program that calculates the sum of integer numbers in the range <1,5>. Use the "for" statement.
5. Write a program that calculates values for the following fractions: 1/2, 1/3, ..., 1/10. First, Use the "while" statement, then, the "for" statement. Sample result:

1/1 = 1.0  
1/2 = 0.5  
1/3 = 0.3333333333333333  
…  
1/10 = 0.1

1. Write a program that calculates the sum of even numbers in the range <1,10>.

## Debugging

1. The following program calculates the sum of the integers in the range 1 to 5. Run the program in debug mode and try to analyse the program execution. See how you can execute the program step by step and track changes in variable values.

sum = 0  
number = 1  
while number <= 5:  
 sum = sum + number  
 number = number + 1  
message = f"Sum of numbers in <1,5> is {sum}"  
print(message)

# After Class

1. Write a program that displays two numbers entered from the keyboard in ascending order.

Enter first number: 27  
Enter second number: 14  
Numbers in ascending order: 14, 27

1. Most female names in Polish end with the letter "a". Write a program that displays the name entered from the keyboard, provided it is a female name. Sample result:

Enter name: Anna  
Anna – Polish female name

1. Write a program that calculates a dog's age in dog’s years. For the first two years, a dog's life is equal to 10.5 human years. After that, each dog year is equal to 4 human years. Sample result:

Enter the dog's age in human years: 15  
The dog's age in dog’s years is 73 years.

1. A computer program analyses the price of a product in an online store. If the product price decreases by at least 10%, the program displays a purchase recommendation:

Buy the product!!  
Product price reduced by 17%

Create such program. The current and previous price of the product are included in the variables. Sample result:

Current product price: 140.00  
Previous product price: 200.00  
Buy the product!!  
Product price reduced by 30%

1. In one of the online stores, a 25% discount is charged for each product purchased over two. Write a program that calculates the amount to be paid. Read the number of purchased products and the product price from the keyboard. Sample result:

Number of products purchased: 5  
Product price: 40  
Amount to pay: 170.00

1. The speed of vehicles on highways in Poland is at least 40 km/h and not more than 140 km/h. Write a program that displays a message when the specified car speed, read from the keyboard, has been exceeded. Sample result:

Enter car speed: 38  
Warning: invalid car speed!!

Use the following variables in your program:

car\_speed  
speed\_limit\_min  
speed\_limit\_max

1. An influencer is a person who can influence other people's behaviour. An influencer communicates with other people using social networking sites. Write a program that checks whether a given person can be a good influencer, that is, whether the person has at least two of the following accounts: Facebook, Twitter or Instagram. Use logical type variables: facebook, twitter, instagram, the value of which indicates whether the person has an account on the social networking site. Sample result:

facebook = True  
twitter = False  
instagram = True  
A person can be a good influencer!

1. EAN-13 (European Article Number) is a barcode for marking goods. The first 3 digits (590) usually indicate goods manufactured in Poland. Write a program that checks whether the EAN-13 number entered from the keyboard consists of exactly 13 characters (digits). Display a message if the number is correct. Additionally, only when the article number is correct, display a message when the product was manufactured in Poland. Sample result:

Enter EAN-13 article number: 5901230094938  
Article number is correct  
Article manufactured in Poland

1. A washing machine allows you to wash a jacket, which takes 40 minutes, wash underwear, which takes 70 minutes, and wash shoes, which takes 20 minutes. In addition, it is possible to program an additional rinse (15 minutes) and an additional spin (9 minutes). The washing machine settings are saved in variables. Write a program that calculates and displays the total washing time. Sample result:

washing\_product = "shoes"  
rinse = True  
spin = False  
Total washing time: 35 minutes

1. Write a program that allows you to convert time in 24-hour format to 12-hour format. The time in 24-hour format (hh:mm) is read from the keyboard. Sample result:

Enter time (24-hour format): 16:32  
Time in 12-hour format: 4:32pm

1. Let x and y denote the coordinates of a point on the plane. Write a program that determines in which quadrant of the coordinate system the point P (x, y) is located or on which axis it is located, or that it is located in the position (0,0) of the coordinate system. Sample result:

x = 5  
y = 2  
Point P(5,2) is in the first quadrant of the coordinate system

1. Yes-no question are often used in surveys to gauge people's attitudes with regard to specific ideas or beliefs. Write a program that displays a survey consisting of three questions. Save the answers to logical type variables. Then view the survey result. Sample result:

Are you interested in computer science? (Y/N): Y   
Do you like playing computer games? (Y/N): N  
Do you have an Instagram account? (Y/N): Y  
Interested in computer science: Yes  
Playing computer games: No  
Has an Instagram account: Yes

1. Write a program that converts a decimal number into a binary number. To convert a decimal number to binary, follow these steps:
   1. Read a decimal number from the keyboard.
   2. Divide the number by 2 and note the remainder.
   3. Divide the quotient obtained by 2 and note the remainder.
   4. Repeat the same process till we get 0 as the quotient.
   5. Write the values of all the remainders starting from the bottom to the top. That will be the required binary number.

Sample result:

Enter decimal number: 12  
12(10) = 1100(2)

1. There are coins of 1, 2 and 5 Polish Zlotys (PLN). Write a program showing any amount (natural number) read from the keyboard with as few coins as possible.

Enter the amount in PLN: 18  
The amount of PLN 18 in coins:  
5 zł – 3   
2 zł – 1   
1 zł – 1

1. Write a program that displays numbers from 1 to 30. If the number is divisible by 3 then the program displays the word 'THREE'. Next, if the number is divisible by 5 then the program displays the word 'FIVE'. Finally, if the number is divisible by both 3 and 5 then the program displays the word 'BINGO'. Sample result:

1 2 THREE 4 FIVE THREE 7 ...

1. Write a program that creates a multiplication table in the range 1 to 10 for any number entered by the user. Sample result:

Enter number: 6  
6 x 1 = 6  
6 x 2 = 12  
6 x 3 = 18  
6 x 4 = 24  
6 x 5 = 30  
6 x 6 = 36  
6 x 7 = 42  
6 x 8 = 48  
6 x 9 = 54  
6 x 10 = 60

1. Write a program that creates the following pattern. Sample result:

\*   
\* \*   
\* \* \*   
\* \* \* \*   
\* \* \* \* \*   
\* \* \* \*   
\* \* \*   
\* \*   
\*

1. Write a program that creates the following pattern. Sample result:

1  
22  
333  
4444  
55555  
666666  
7777777  
88888888  
999999999

1. The variables a and b contain the dimensions of the sides of the rectangle. Write a program that creates the following rectangle with dimensions a and b. Sample result for a = 4 and b = 15:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  
\* \*  
\* \*  
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

1. The 'university' variable contains the name of university where you are studying. Write a program that displays the contents of the variable with an extra space between characters (add a space between each character). Sample result:

Krakow University of Economics  
K r a k o w U n i v e r s i t y o f E c o n o m i c s

1. The payment card is secured with a four-digit PIN code (0805). Write a program that checks if the PIN code entered in the payment terminal is correct. The user has up to three possibilities for entering a PIN code. In case of three unsuccessful attempts, the card is blocked. Sample result:

Enter the PIN code: 2398  
Incorrect...  
Enter the PIN code: 0912  
Incorrect...  
Enter the PIN code: 7860  
Incorrect...  
Sorry, your payment card has been blocked.

1. A computer numeric keyboard has the arrangement of the keys as below. The included program code displays the computer keyboard. Analyse the program in terms of the displayed results. Do you understand each program statement? Then make a change in your program code. Replace the ‘for’ with a ‘while’ statement.

7 8 9  
4 5 6  
1 2 3

for i in range(6,-1,-3):  
 for j in range(1,4):  
 print(f' {i+j}',end='')  
 print()

1. Write a program that displays the first twenty words of the Fibonacci sequence. The sequence is defined as follows: the first term is equal to 0, the second is equal to 1, each subsequent term is the sum of the previous two. Sample result:

https://en.wikipedia.org/wiki/Fibonacci\_number

0 1 1 2 3 5 8 13 21 34 ...

1. Write a program that calculates the sum and arithmetic mean of numbers entered from the keyboard. Entering 0 ends entering numbers. Sample result:

Enter number: 15  
Enter number: 8  
Enter number: 10  
Enter number: 0  
RESULT: Quantity=3, Sum=33, Mean=11

1. A natural number greater than 1 is called a prime if it has exactly 2 natural factors with the values 1 and this number. Write a program that finds N leading prime numbers. Read the value of N from the keyboard. Using loop statements check that the number N is divisible only by 1 and by N.

Prime numbers: 2 3 5 7 11 …

1. Write a program that displays a lottery coupon (numbers from 1 to 49) in the format as below.

1 8 15 22 29 36 43  
 2 9 16 23 30 37 44  
 3 10 17 24 31 38 45  
 4 11 18 25 32 39 46  
 5 12 19 26 33 40 47  
 6 13 20 27 34 41 48  
 7 14 21 28 35 42 49

1. Write a program that displays 20 integer random numbers in the range of 5 to 10.