Types and Variables

# Before Class

1. Familiarise yourself with the computer architecture according to von Neumann:

<https://youtu.be/sG4nd97PeHw>

1. Explain the concepts:
   1. data type – data type describes what kind of value we will hold there. This could be eg. it could be integer number, string, or Boolean.
   2. Variable – it’a a “box” for holding our value. It must have name and in some programming languages it also contains type of value.
   3. Operator – it’a like a tool in programming what is used to compare values or do some mathematic processes.
2. Find out what data types and operators are available in Python.  
   In python we can find data types like: string, Boolean, float, integer, number etc.
3. On your computer, open a terminal window. Then run Python in interactive mode by typing the py command (remember to install Python).

Now read the contents of "3. An Informal Introduction to Python ”available in the tutorial: <https://docs.python.org/3/tutorial/index.html>. Try to do on your computer all examples available in this introduction.

# During Class

## Types, operators and expressions

1. Consider what data type the following values represent. Then check your answers. You can use the available type(value) function
   1. 50 - integer
   2. 149.17 - float
   3. 4 \* 7 - integer
   4. 4.0 \* 7 - float
   5. "University" - string
   6. True - boolean
   7. 2 > 5 - boolean
2. What is the type and value for the following expressions. First, calculate an expression without using a computer. Then check the results on your computer.
   1. 3 – 2 + 1 = 2
   2. 5 + 10 \* 5 = 55
   3. 4 + 4 / 2 \*\* 2 = 5
   4. 4 % 3 % 2 % 1 =0
   5. 1 + 2 % 3 \*\* 4 \* 5 = 81
   6. True != False = True

## Variables

1. Natural values 5, 1, 8, 6, 3 have been assigned to variables named: n1, n2, n3, n4, n5. Using only variables, create the following expressions:
   1. sum of all variables.   
      n1+n2+n3+n4+n5
   2. sum of squared variables.  
      n1\*\*2+n2\*\*2+n3\*\*2+n4\*\*2+n5\*\*2
   3. quotient of the variable three and five.  
      n3/n5
   4. display a message (True / False) indicating if the third variable is equal to the fourth.  
      print(n3==n4)
2. The variable x has a value of 7 and the variable y a value of 34. In interactive mode, swap variable values (the variable x should be 34 and the variable y the value 7). You can use one additional, auxiliary variable.  
   x=7  
   y=34  
   tmp=x  
   x=y  
   y=tmp

## Data input

1. In interactive mode, read your name and surname from the keyboard. Store this data in two separate variables. Then display your first and last name separated by a single space.  
   name=input("Your name: ")  
   surname=input("Your surname: ")  
   print(name, surname)
2. In interactive mode, read two integers from the keyboard. Then display their sum. Pay attention to the need to convert the data from the keyboard. Use the int() function.  
   num1=input("Number1: ")  
   num2=input("Number2: ")  
   print(int(num1)+int(num2))

## Data output

1. The variables name, age and height contain your personal data. Using the formatted string literals (f-strings) (https://docs.python.org/3/tutorial/inputoutput.html), display the following sentence:

My name is ..., I’m ... years old, and my height is ... cm  
  
name="Wojciech"  
age="20"  
height="175"  
print(f"My name is {name}, I'm {age} years old, and my height is {height} cm")

1. A variable contains any integer. Using the str.format() method, display this number and its second power.

The value is …, and … is its second power is … .  
  
variable=21  
print("The value is {value}, and {value} is its second power is {value}".format(value=variable))

## Programs

1. The radius of the circle has the value 5. Write a program that calculates the area and circumference of the circle. Use the algorithm below.

#####  
# Calculation of the area and circumference of a circle  
##  
# determine radius and PI  
import math  
radius=5  
PI=math.pi  
# calculate area   
area=PI\*radius\*\*2  
# calculate circumference   
circumference=2\*PI\*radius  
# display results   
print(f"Area: {area}, circumference: {circumference}")

1. Write a program that reads the temperature in degrees Celsius from the keyboard. The program then calculates and displays the temperature in Kelvin and Fahrenheit.  
     
   temp\_celsius=int(input("Write temperature in Celsius: "))  
   temp\_kelvin=temp\_celsius+273.15  
   temp\_fahrenheit=temp\_celsius\*1.8+32  
   print(f"Celsius: {temp\_celsius}, Kelvin: {temp\_kelvin}, Fahrenheit: {temp\_fahrenheit}")

# After Class

1. Evaluate the following expressions.
   1. The product of 15 and 38
   2. The product of the sum of the pairs of numbers 3 and 4, and 5 and 9
   3. Integer part of dividing the numbers 7 and 2
   4. The remainder of the division of 48 and 5
   5. Arithmetic mean of the numbers 8, 7, 4, 2
   6. 210
   7. Square root of 49 (do not use a function)
   8. 25% of 80
2. What are the values of the following expressions? Answer without using the computer. Then check the results on your computer, in interactive mode.
   1. 5 + 10 \* 5
   2. 3 – 2 + 1
   3. 2 + - 3
   4. 2 \*\* 8
   5. 4 + 4 / 2 \*\* 2
   6. 4 % 3 % 2 % 1
   7. 1 + 2 % 3 \*\* 4 \* 5
   8. True != False
   9. 2 <= 3 or False
   10. not True or not False and not True
   11. 2 < 3 and 4 < 5 or not 6 < 7
   12. 2 % 3 < 4 / 5 and 6 + 7 < 8 or not 9 + 10 == 19
   13. 0b11111 >> 1 >> 1 >> 1
   14. 0x11 + 0b11 + 11
   15. 2 << 3 >> 4
3. In interactive mode, calculate and display your height in feet and inches. Sample result:

I am 170cm tall, i.e. 5 feet and 7 inches.

1. The length of the sides of the triangle is a, b and c. Write a program that calculates the area of the triangle using the Heron formula. Read the values of the sides of the triangle from the keyboard. Using the program, calculate the area of the triangle for the sides 3, 4 and 5.
2. Write a program that calculates the Body Mass Index (BMI) based on your height in cm and weight in kg. The user enters the data from the keyboard. Find the formula on the Internet for calculating BMI. Then, using your program, check that you have the correct weight. Sample result:

Enter your height in cm: ...  
Enter your weight in kg: ...  
BMI index: ...

1. Write a program that displays the results of three dice rolls and the sum of the dice rolled. Apply a random number generator:

<https://docs.python.org/3/library/random.html>

1. Write a program that enables the user to face the computer. The computer throws a dice. The user then tries to guess the number from a dice by entering a number from 1 to 6 from the keyboard. If the user has guessed the number from the dice, the computer displays True.
2. 23% VAT was paid from the amount of PLN 15.84. Calculate and display VAT. Apply formatting with decimal places. Sample result:

Amount : 15.84 zł  
VAT 23% : 3.64 zł