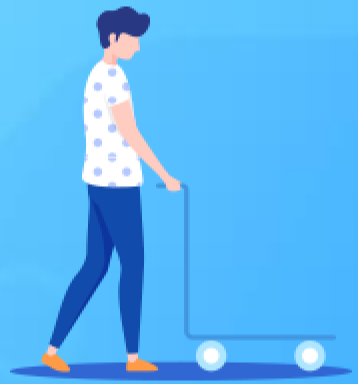
Python Coding

Coding workshop



Simona

Professor in Vilnius Gediminas Technical University

Member of MERIT project – dedicated to develop advanced digital skills in EU

simona.ramanauskaite@vilniustech.lt mima#9498 sim.ram.7

OUR PLAN FOR TODAY

- 10:30 Introduction to Python
- 12:30 Lunch
- 13:30 Continuing with Python
- 15:00 End of course day

WHY WE WILL LEARN

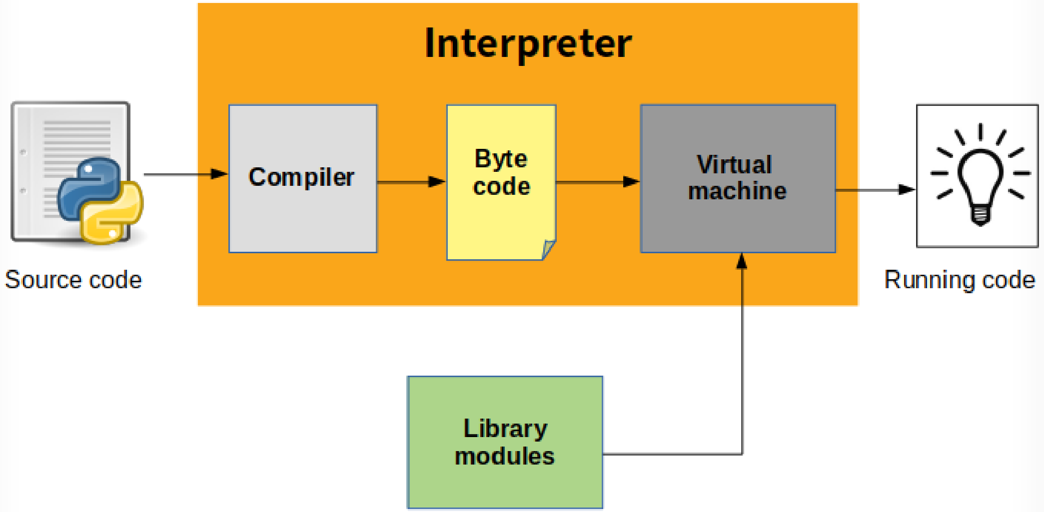
Python

Software will replace boring work for humans.

Programming skills might be required in future.

Python is easy to learn, widely used, and portable.

Where we write the code



Install Python into our computers

A

We can write a Python code in text editor (Notepad) or special editor (PyCharm, Visual Studio, etc.) and then execute it in Python

Use web services

B

https://colab.research.google.com/ or other systems provide an environment to write the code and execute it in Python

Use beginner oriented services

C

Use graphical editors like https://edublocks.org/, https://think.cs.vt.edu/blockpy/blockpy/

What we need in programming

Input/ Output

We should input or receive some data

Variables

Software need to “remember” the data which it processes

Data processing

Software should do some calculations or actions with the data

Flow control

Conditions and repetitions could accur in the code

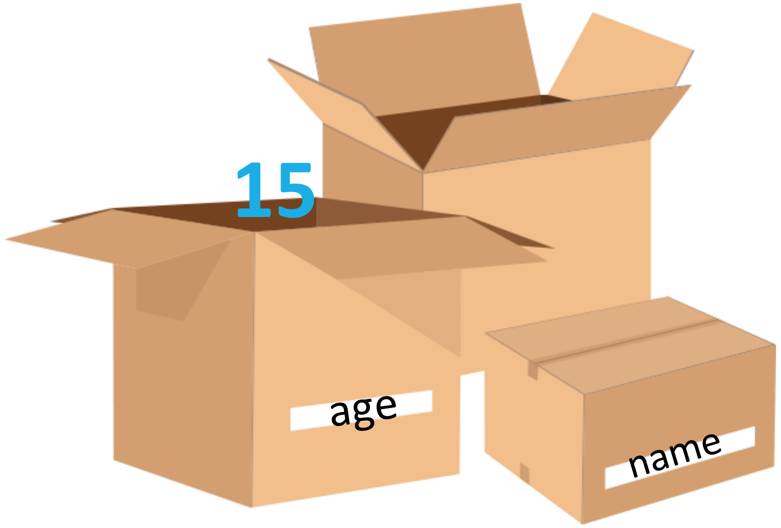
Variables

A variable is a symbolic name that defines a place where we store some data.

Once a value is assigned to a variable, we can refer to the data by that name.

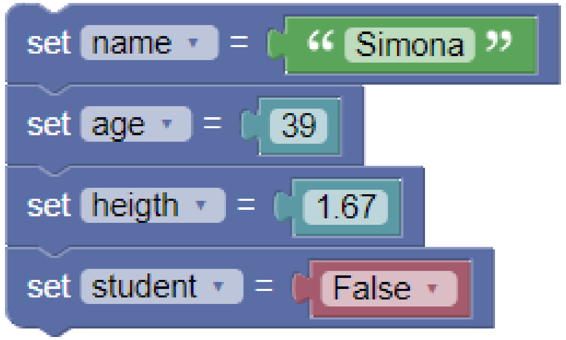
It is easier to remember name, than address, location.

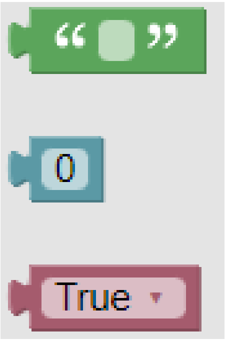
We can assign the value to the variable or update it.



Variable names have some rules:

- It should be composed of text symmbols, digits and underscores, no special symbols are allowed
- It must start with text symbol or _, but not digit
- It is case sensitive – Var1 and var1 will mean two different variables
- There are some reserved, not allowed names for variables





Variables have different types:

- string defines a text data. It should be written between quotation symbols
- numberic data stores one numeric value. It can be ineger or floa value
- boolean data has only two values - True or False

We will discuss other types later

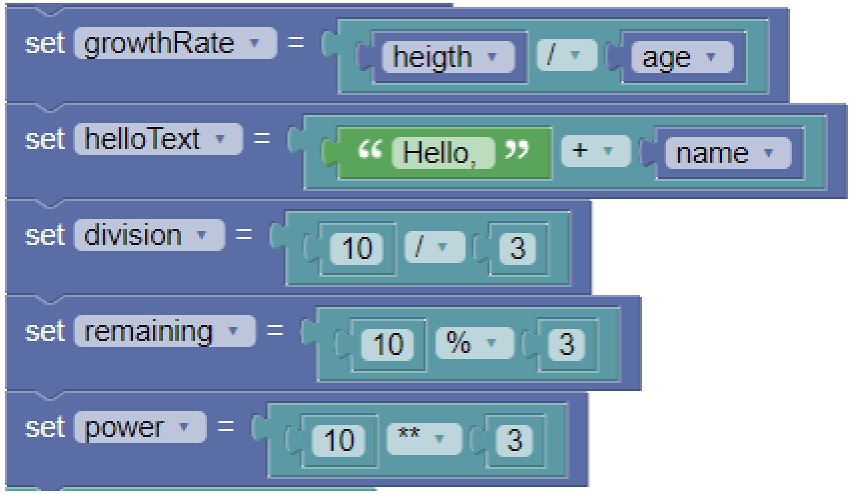
```
name = 'Simona'
age = 39
heigth = 1.67
student = False
```

Data processing

We can execute mathematical operations with numbers:

- Add numbers +
- Subtract numbers -
- Multiply *
- Divide /
- Get remaining of the division %
- Rise one number by other **

Several texts can be concatenated with + operation as well

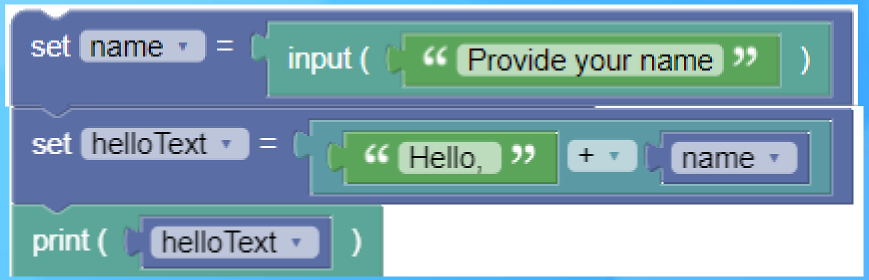



```
growthRate = heigth / age
helloText = 'Hello, ' + name
division = 10 / 3
remaining = 10 % 3
power = 10 ** 3
```

Data input/output

Input is what the software gets as data.

The value to a variable is assigned by input, not hardcoded by programmer.




```python
name = input('Provide your name')
helloText = 'Hello, ' + name
print(helloText)
```

Output is what the software returns to us.

The value of variables or other data is shown or stored in some output.

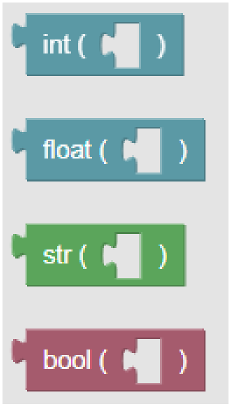
Type conversion

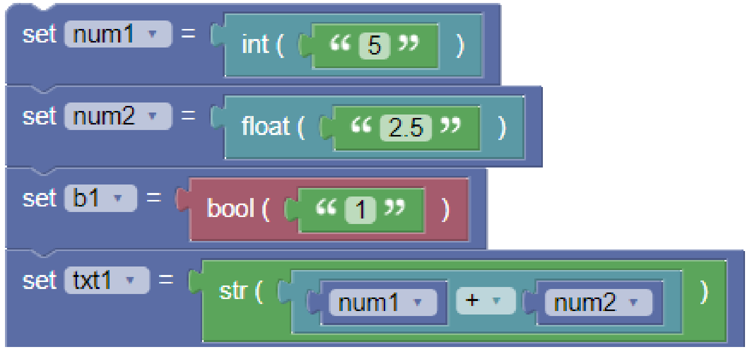
From input we usually get text

Mathematical operations can not be executed with text

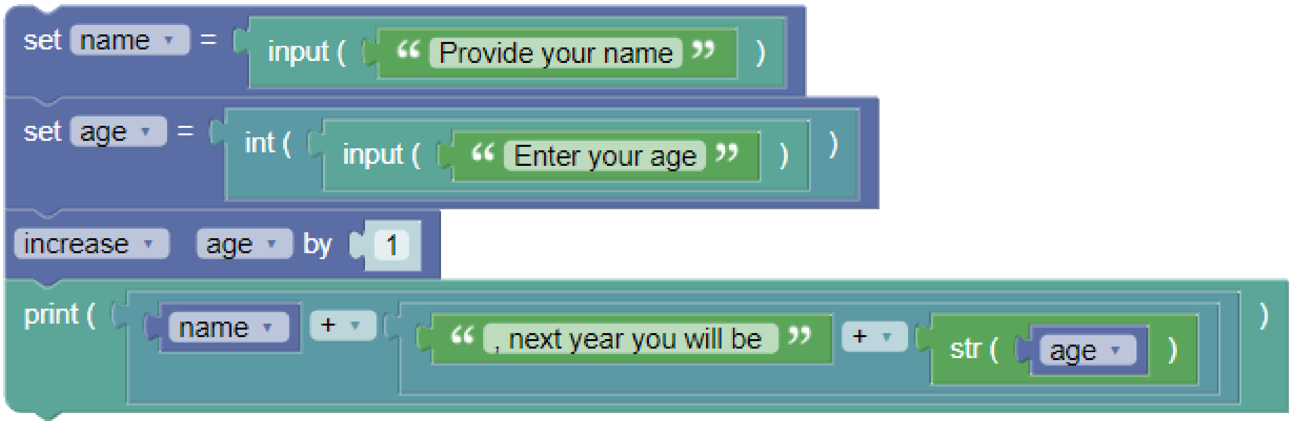
If numeric values are read, we need to convert the text input to numeric value

If we want to concatenate text with numeric value, the numeric value have to be converted to text






```
num1 = int("5")
num2 = float("2.5")
b1 = bool("1")
txt1 = str(num1+num2)
```



TASK 1

Read data from input:

- *Country name*
- *What is the area size*
- *What is the population*

Calculate what is the average area for one person in the country

Round the average area size for ne person

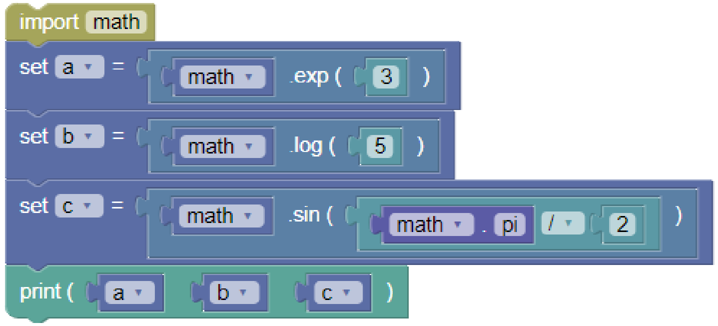
Output the country name and the rounded average area for one person

Other operations

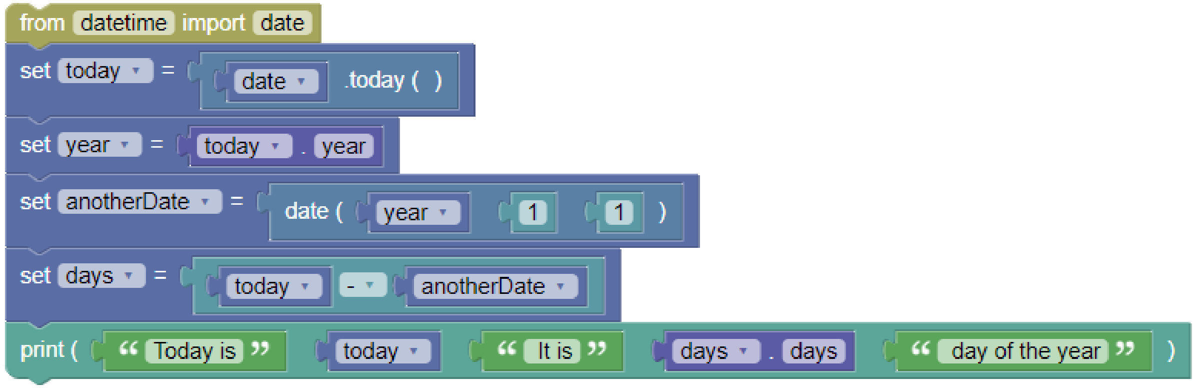
Additional libraries can add extra functionality

- https://docs.python.org/3/library/math.html
- https://docs.python.org/3/library/datetime.html
- …

```
import math
a = math.exp(3)
b = math.log(5)
c = math.sin(math.pi/2)
print(a, b, c)
```

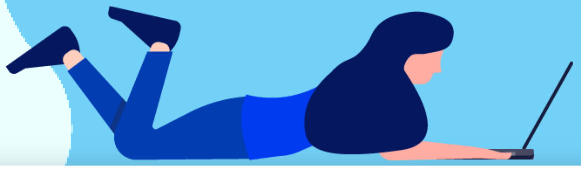



```
from datetime import date
today = date.today()
year = today.year
anotherDate = date(year, 1, 1)
days = today-anotherDate
print("Today is", today," It is",days.days," day of the year")
```



Working with files

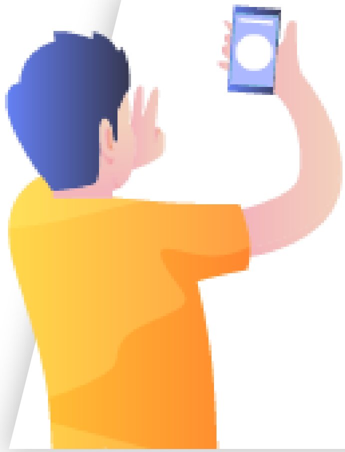
```
f = open("file.txt", "w")
f.write("hello")
f.close()

f2 = open("file.txt", "r")
duom = f2.readline()
f2.close()
print(duom)
```



TIME FOR

Lunch

We will continue after the lunch



PROGRAM FLOW AND LOGIC IN

Python

Conditions and loops

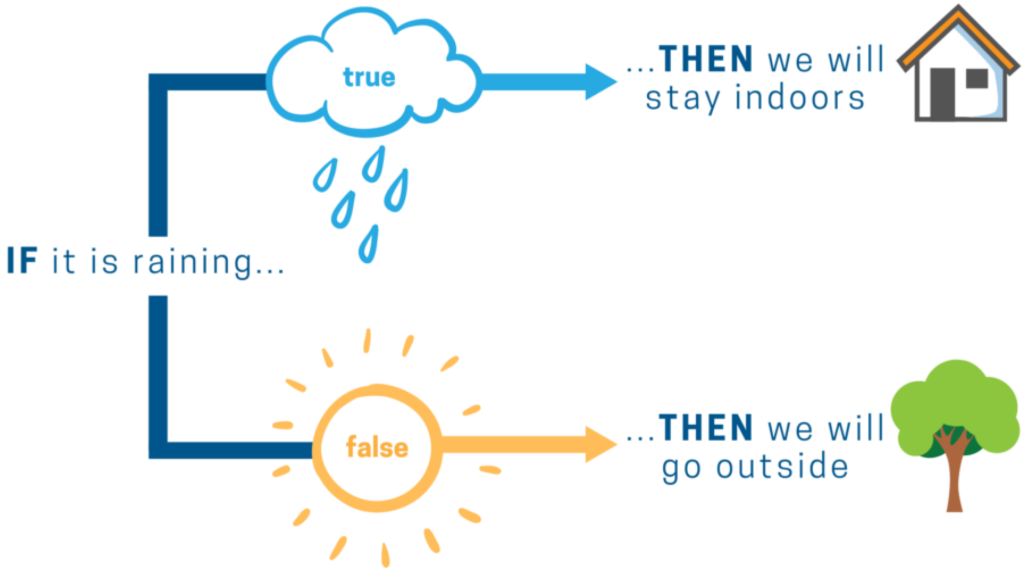
Functions

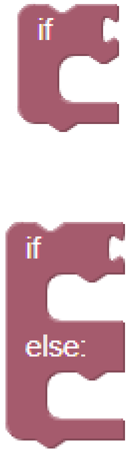
Forks of the flow

We make some decision in life, therefore conditions are needed in software as well

We should make a “question” to get answer True or False

For decisions we can use bool variables or define a condition or its logic






```
if condition:
    print("what if the condition is True")
else:
    print("what if the condition is False")
```

Flow diagram

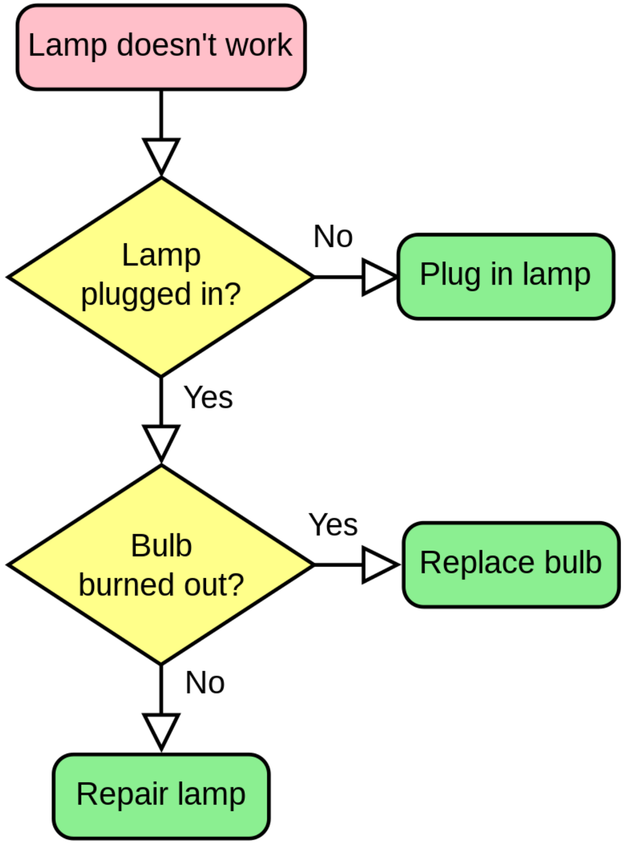
Before programming, the flow of the code could be presented in a diagram

- Diamond illustrates a condition
- It has one flow for Yes and one for No
- Arrows indicate the flow sequence

From the diagram, the flow can be transformed into the code

```
if Lamp plygged in?:
    if Bulb burned out?:
        Replace bulb
    else:
        Repair lamp
else:
    Plug in lam
```

```
if pugedIn == True:
    if burnedBulb == True:
        replace()
    else:
        repairLamp()
else:
    plugLamp()
```



Conditions

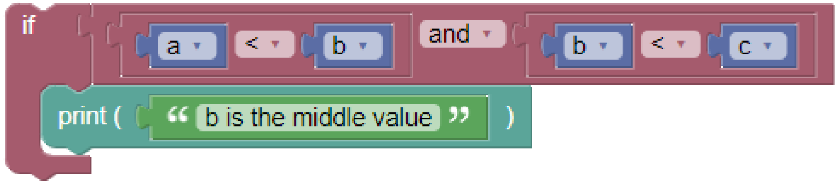
In conditions we compare variable value to another value

All mathematical comparison operators apply

To estimate are the values equal, == operator is used

Several conditions can be combines into one condition

==	and
!=	or
<	
<=	
>	
>=	
is	
is not	
in	
not in	




```
if a<b and b<c:
    print("b is the middle value")
```


```
yourAge = int(input('What is your age?'))
if yourAge < 5:
    print('You are too your for school')
else:
    student = input('Are you a student? Yes or No')
    if student == 'Yes':
        school = input('Where is your school located?')
```

TASK 2

1 *Find rules for vaste sorting*

2 *Draw a flow diagram, based on the rules*

3 *Implement the data input, based on the logic of vaste sorting*

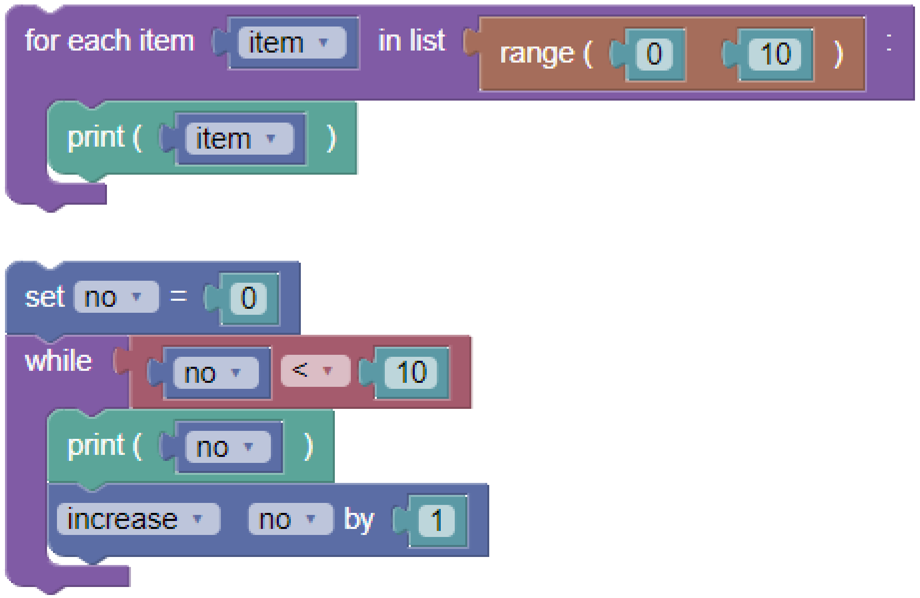
4 *Outpus the final result, there the vaste should be placed, into which contained*

Loops

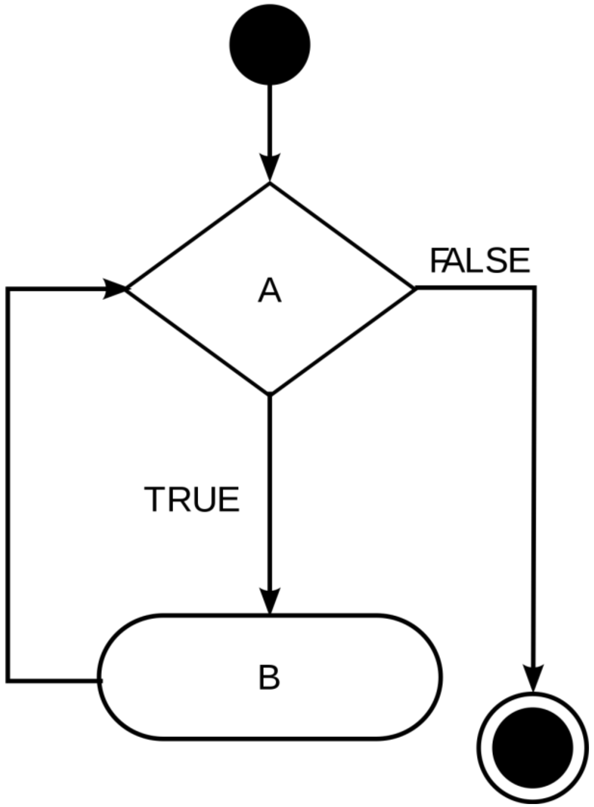
Loop is a repetition of some actions

We need to define how many times it should be repeated or when it should be stopped

Be careful of infinitive loops




```
for item in range(0, 10):
    print(item)

no = 0
while no < 10:
    print(no)
    no += 1
```



Lists

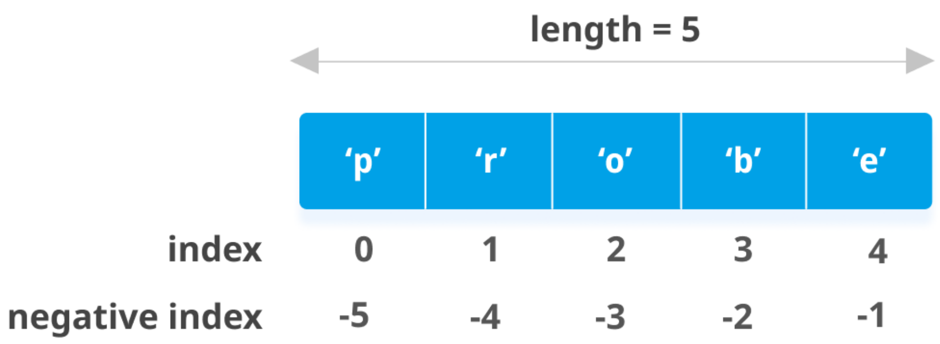
Typically one variables stores one value

There are variables, which are storing list of values

The values are stored in the same order it was added to the list

The position of each values is defined by the index

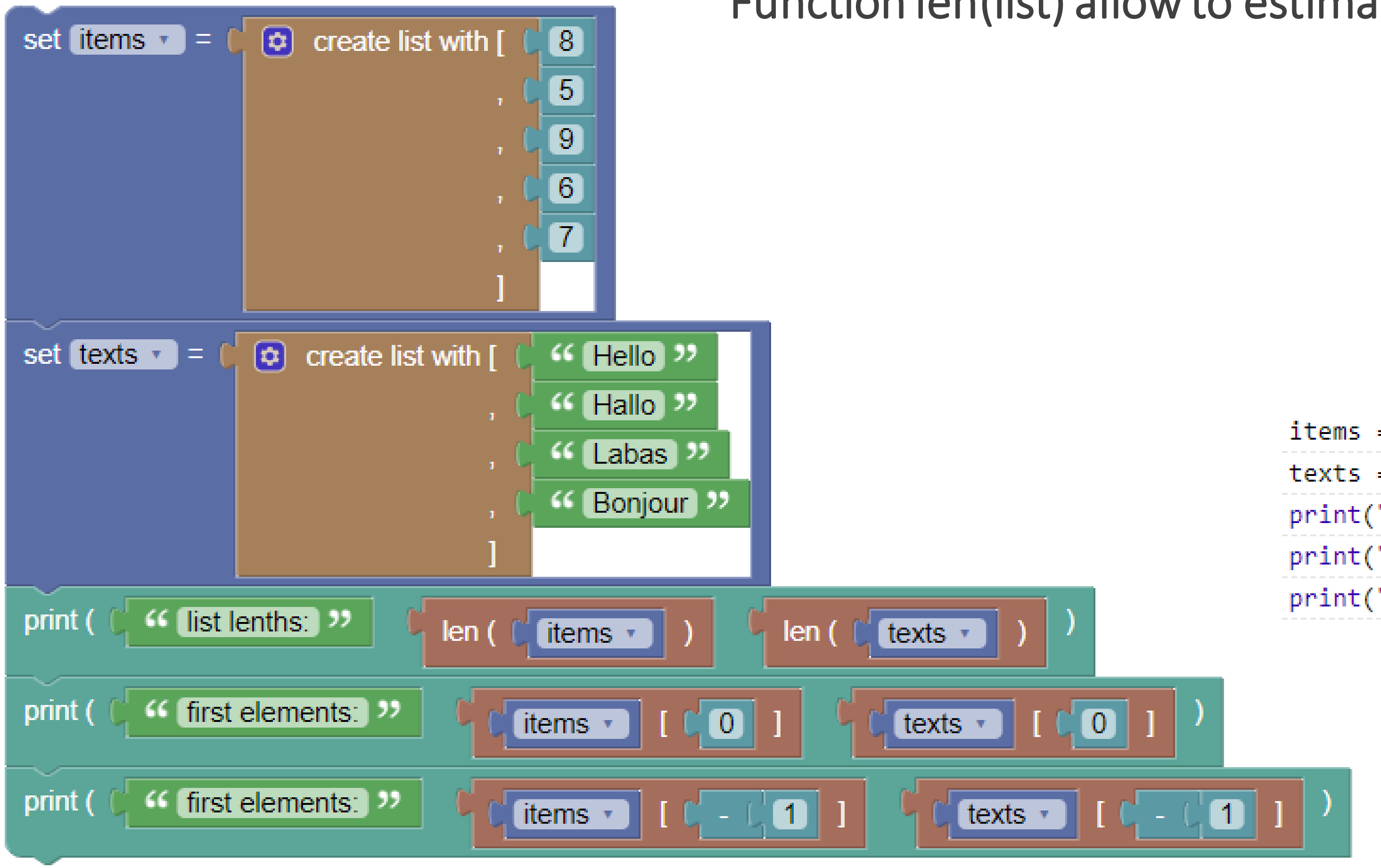
Indexes start from 0 and are increased by one for each new value



Lists

We can access each value of a list by presenting the value index

Function len(list) allow to estimate the length of the list

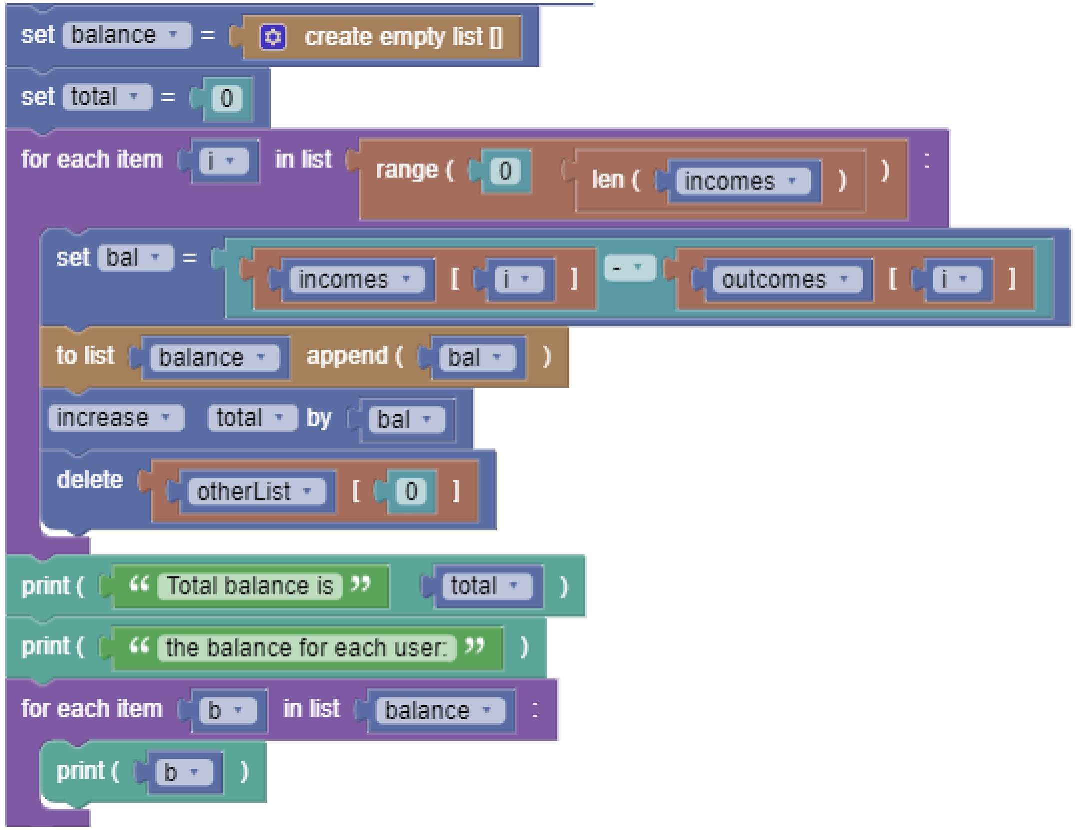



```
items = [8, 5, 9, 6, 7]
texts = ["Hello", "Hallo", "Labas", "Bonjour"]
print("list lenths:",len(items), len(texts))
print("first elements:",items[0],texts[0])
print("first elements:",items[-1],texts[-1])
```

Lists

We can add new values to the list with function append(value)

We can delete elements from list with del list[index]

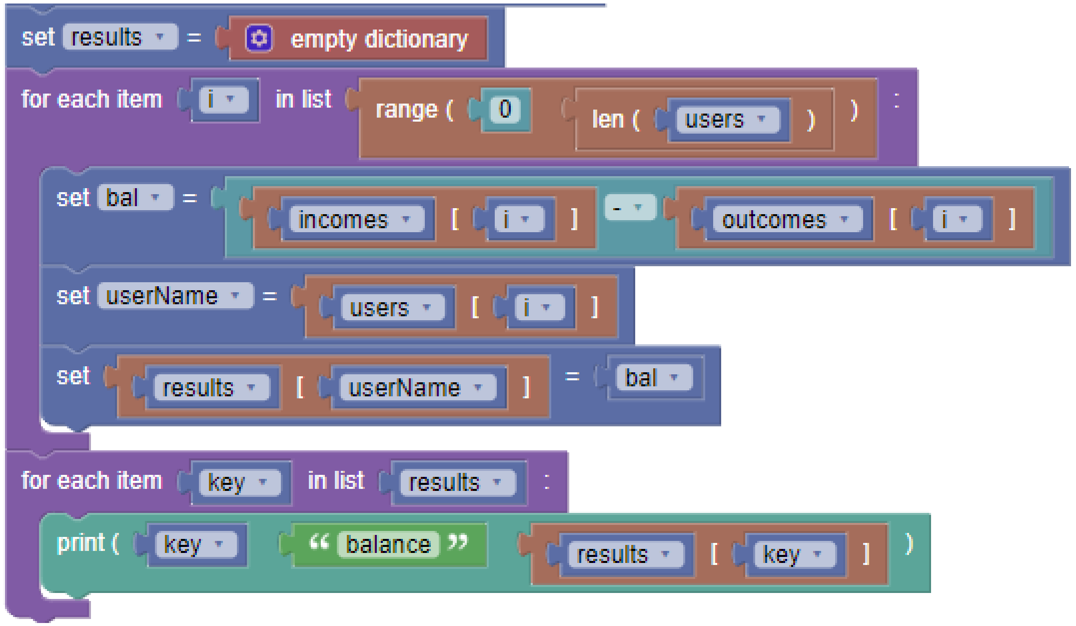



```python
incomes = [80, 57, 93, 66]
outcomes = [8, 15, 9, 26]
otherList = [72, 84, 45, 89, 76]
balance = []
total = 0
for i in range(0, len(incomes)):
    bal = incomes[i]-outcomes[i]
    balance.append(bal)
    total+=bal
    del otherList[0]
print("Total balance is",total)
print("the balance for each user:")
for b in balance:
    print(b)
print(otherList)
```

Dictionary

Dictionary is similar to list, but its indexes should be specified by programmer

To add value we just assign the new value to by key defined element



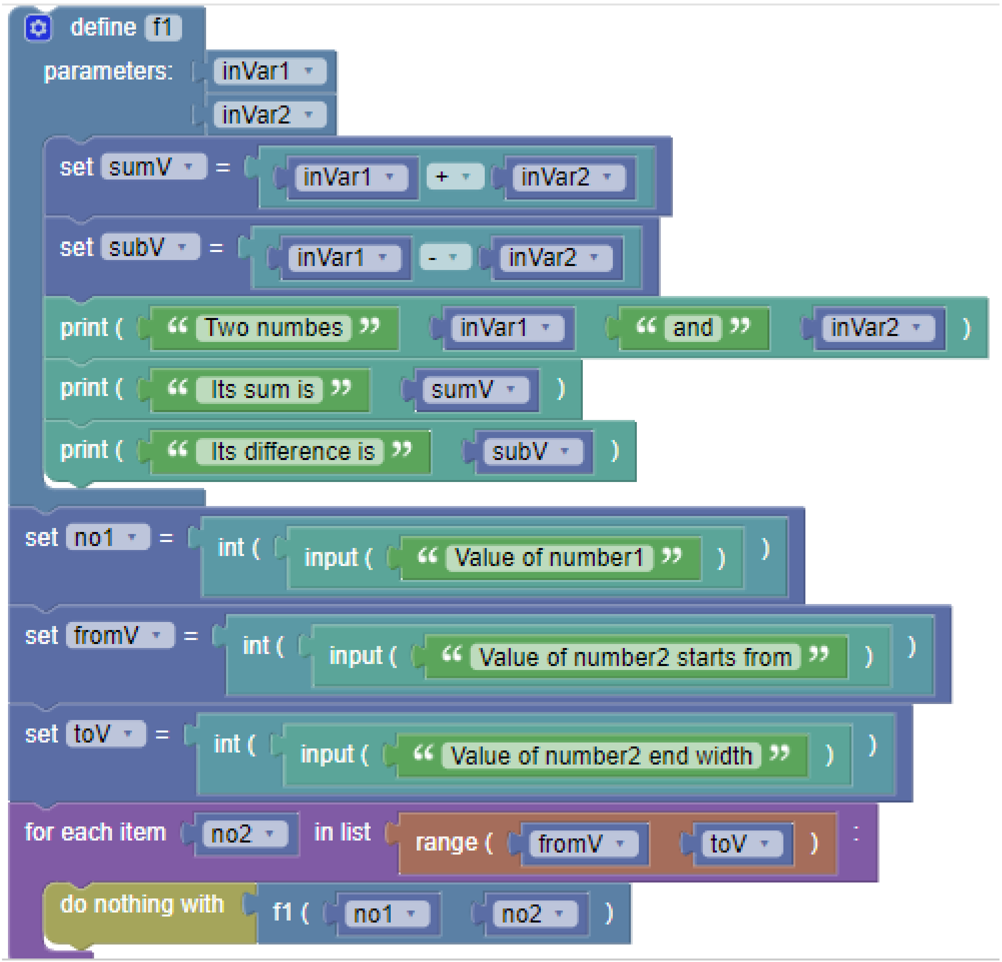

```python
users = ["John", "Anna", "Ruth", "Peter"]
incomes = [8, 15, 9, 26]
outcomes = [72, 84, 45, 89]
results = {}
for i in range(0, len(users)):
    bal = incomes[i]-outcomes[i]
    userName = users[i]
    results[userName] = bal
for key in results:
    print(key, "balance", results[key])
```

Functions

First we define the function

Then we can call the function

```
def f1(inVar1, inVar2):
    sumV = inVar1 + inVar2
    subV = inVar1 - inVar2
    print('Two numbes', inVar1, 'and', inVar2)
    print(' Its sum is', sumV)
    print(' Its difference is', subV)
no1 = int(input('Value of number1'))
fromV = int(input('Value of number2 starts from'))
toV = int(input('Value of number2 end width'))
for no2 in range(fromV, toV):
    (f1(no1, no2))
```



TASK 3

Implement an interactive menu, allowing functionality:

- *Analyze vaste sorting container assignment*
- *Get history of analyzed data*
- *Close the program*

Modify task 2 to have lists of analyzed vastes and assigned container to it

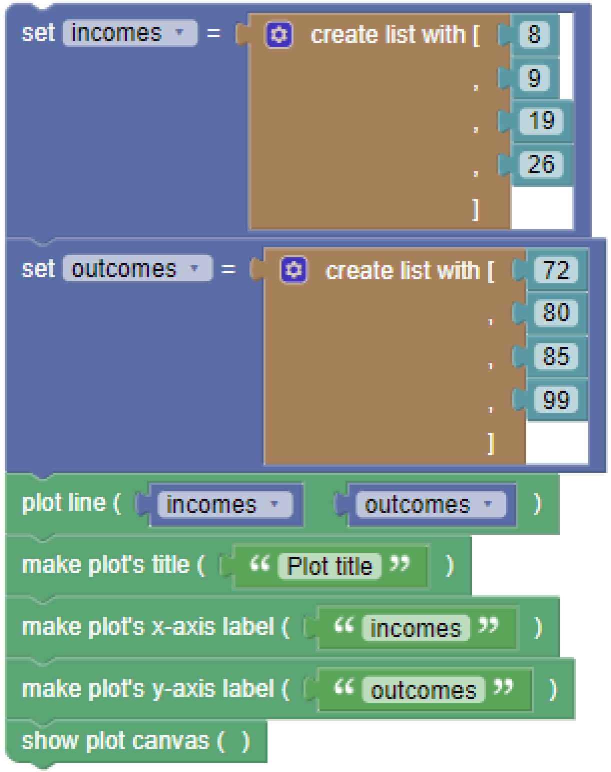
Move the code of one vaste analysis to a function

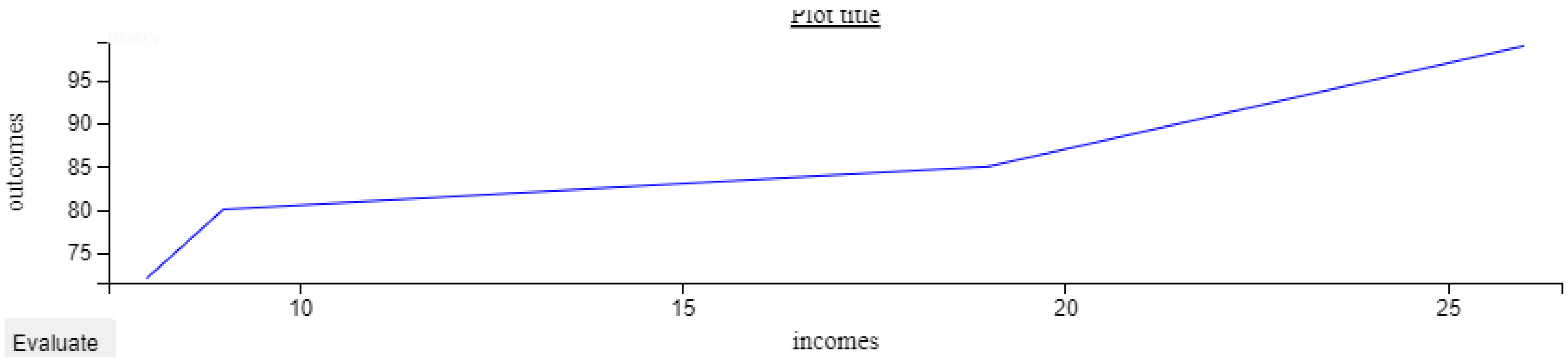
Implement the repetitive call of the function

Plots

Numeric data can be presented as diagrams

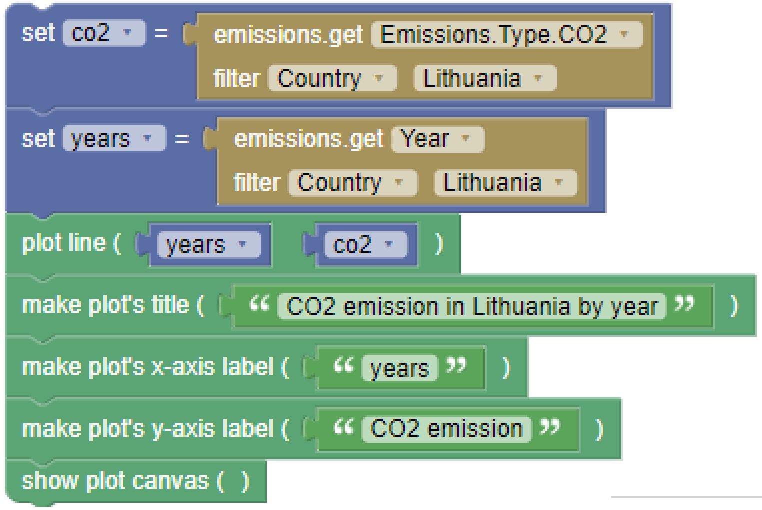
```
import matplotlib.pyplot as plt

incomes = [8, 9, 19, 26]
outcomes = [72, 80, 85, 99]
plt.plot(incomes, outcomes)
plt.title('Plot title')
plt.xlabel('incomes')
plt.ylabel('outcomes')
plt.show()
```



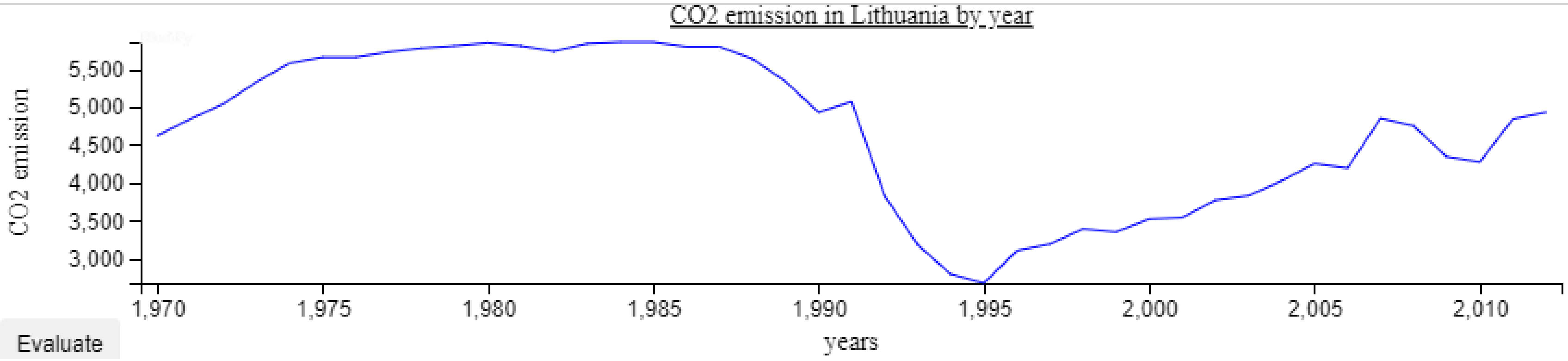


Datasets

Some predefined datasets are available for analysis

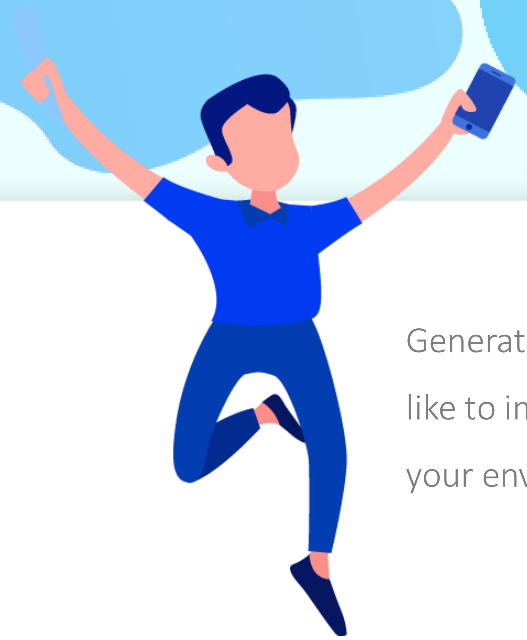



```
import emissions
import matplotlib.pyplot as plt

co2 = emissions.get('Emissions.Type.CO2','Country','Lithuania')
years = emissions.get('Year','Country','Lithuania')
plt.plot(years, co2)
plt.title('CO2 emission in Lithuania by year')
plt.xlabel('years')
plt.ylabel('CO2 emission')
plt.show()
```



IDEAS FOR TOMORROWS

Projects



Generate an idea what you would like to implement in Python as your environment related project

Checklist for the ideas

1 Data input

What data will be inputted and how

2 Calculations

What calculations will be done with the data

3 Variance

What variations exist and might require app flow logic definition

4 Results

How you will store and present the results

Possible ideas

- Analyze pollution data and find the most polluting country
- Estimate which transport way is most suitable for person
- Estimate when persons vaste would be fully degraded
- Estimate how much different vaste person generates per month

THANK YOU

Be free to contact me if you will have any questions now or in the future