PHOT 110: Introduction to programming

Practical 4: Loops and lists

Michaël Barbier, Spring semester (2024-2025)

1. Printing numbers

- Use a while loop to print the numbers from 1 to 10 to the screen.
- Then use a for loop for the same task. Make use of the `range()` function for this.
- Finally, use a `for` loop to print the odd numbers from 1 to 10 to the screen.

As an example, the output of the last part should give:

```
Print odd numbers 1-10 using a for loop
1
3
5
7
9
```

2. Decreasing series

- Use a `while` loop to print the terms of series $\sum_{n=1}^{\infty} \frac{1}{n^4}$ for which $\frac{1}{n^4} \geq 0.0001$.
- Repeat the same task but using a `for` loop (combine with a conditional statement). Remark that here the lazy evaluation of the `range()` function is also a benefit.

Output of either script should have following output:

```
1.0
0.0625
0.012345679012345678
0.00390625
0.0016
0.0007716049382716049
0.00041649312786339027
0.000244140625
0.00015241579027587258
```

3. Game of higher-lower

Create a simple version of the higher-lower game where a person thinks of a number and the other has to guess it. Generate a random number using following code:

```
import random
n = random.randint(0, 100)
```

Afterwards, prompt the user repetitively to make a guess, and tell each time whether the number is higher or lower than the guess. If the user guesses the actual number, stop the game. See following example output of a correct working script:

```
Guess the number [0, 100]: game started!
What is the number? 45
The number is lower, try again.
What is the number? 10
The number is lower, try again.
What is the number? 4
The number is higher, try again.
What is the number? 7
Yes, that is the number! Congratulations, you guessed it in 4 guesses.
```

4. Printing elements of a list

Create the following list:

[“yellow”, “green”, “blue”, “red”, “white”, “orange”, “black”]

a. Print the last element to the screen
b. Print the sublist containing the colors of the Turkish flag
c. Print the sublist with the colors of the rainbow (ignore black and white) and order them according to increasing wavelengths
d. Print all the elements one by one to the screen using a loop.
e. Prompt the user to tell his favorite color which is not in the list. If not in the list, append it to the list. Otherwise reply that it is already in the list.

Example output for tasks (a) and (b):

```
Last color in the list:
black
List of colors of the Turkish flag:
['red', 'white']
```

5. List of soccer players

Define a list containing the names of some of the soccer players from the Kazakhstan national football team (men):

[“Maksim”, “Abat”, “Oralkhan”, “Ramazan”, “Vyacheslav”]

Then perform the following tasks:

- Print the names of the list to the screen line-by-line by using a for loop.
- Print the names in reversed order to the screen. Hint: You can use `len()` and `range()` functions.
- Append the name “Dastan” to the list. Print the list, did it change?
- Select the second player from the list and print: “[players_name] is the best player!” to the screen.
- Remove player “Abat” from the list.

Example output for the second subtask:

```
Players in reverse order:
Vyacheslav
Ramazan
Oralkhan
Abat
Maksim
```

6. Selling fruit

A salesperson sells fruit on the market. Create a list with the following pieces of fruit that he has initially:

[“banana”, “apple”, “kiwi”, “banana”, “banana”, “orange”, “apple”, “kiwi”, “strawberry”, “peach”]

Create an empty list/basket for a customer. Repeatedly prompt the user/customer what he likes to buy. If still available, remove once from the list and add to the basket of the customer. If not in the list (or not an existing word) print that you don’t have that. Stop when the user says: “That’s all”, and print the basket-list of the customer.

Possible output of a working script:

```
What do you like to buy: cherry
Sorry, today I don't have any cherry.
What do you like to buy: banana
Here you go.
What do you like to buy: apple
Here you go.
What do you like to buy: That's all
You bought following fruit:
["banana", "apple"]
```

7. Prime numbers

Ask the user to give a positive number n. Verify whether this number is prime (does not have any integer divisors except 1 and n). For this you can loop over all numbers $m \leq \sqrt{n}$ and check whether n/m is a natural number.

Example output of a working script:

```
Please provide a positive number: 14
The number 14 is not a prime number.
```