PYTHON FOR LOOPS

LEARNING OBJECTIVES:

- 11.1.2.4 WRITE PROGRAMME CODE USING A FOR LOOP;
- 11.1.2.5 DEFINE A RANGE OF VALUES FOR A LOOP;
- 11.1.2.6 DEBUG A PROGRAM;
- 11.4.3.2 SOLVE APPLIED PROBLEMS OF VARIOUS SUBJECT AREAS.

FOR LOOPS

- In order to make repetitive calculations, special constructions have been created in programming languages, which are called loops. They help the computer to calculate some values a very large number of times.
- In Python there are 2 types of loop: For and While.
- The for loop is much faster, this is due to the fact that there are no logical checks in it. It is suitable for any iterable object (those that can be computed a finite number of times). Not only numbers are suitable, but also strings and lists, which makes it more versatile.

FOR LOOPS

The for loop executes a block of code a specified number of times.

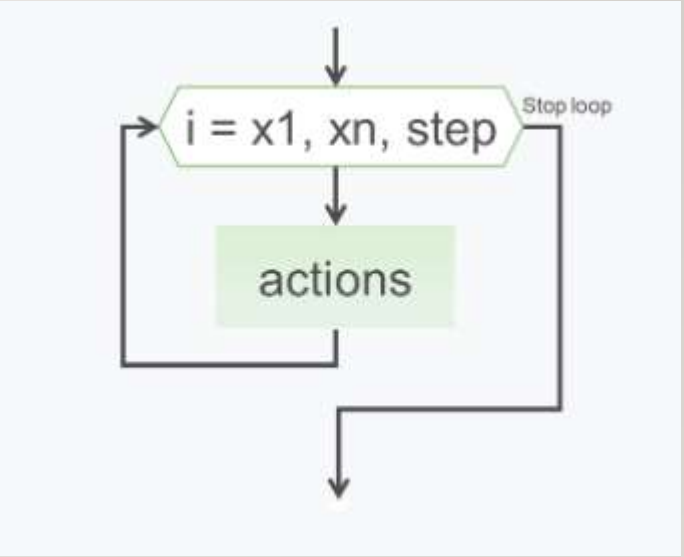
Syntax

```
for ... in range(...):
    code block (loop body)
```

after for is an iterator variable, the range is a range of values, for example,

```
for i in range (n): # where n is an integer
    code block (loop body)
```

This means that the iterator i will accept all integer values from 0 to n (not inclusive). The loop will be executed n times.



EXAMPLE

- *Task. Print all integers from 0 to n (not inclusive).*

```
n = int(input()) # if n = 3
for i in range(n): # iterator i will take values 0, 1, 2
        print(i) # each time the output of the iterator value will be on a new line
 ----------------
Output:
0
1
2
```

RANGE () ARGUMENTS

The range() function returns a sequence of numbers, starting from 0 by default, and increments by 1 (by default), and stops before a specified number.

If the range is set to **one number**, the iterator goes from 0 to the preset value (not including).

```
range(5) -> [0,1,2,3,4]
```

If you specify **two numbers**, it is the initial value of the iterator and end.

```
range(2, 5) -> [2,3,4]
```

If there are **three numbers**, it is not only the start and the end value of the iterator but the step iterator.

```
range(0, 5, 2) -> [0, 2,4]
```

EXAMPLE

Task 2. The following program counts the sum of all integers that are less than n.

```
n = int(input())
total = 0
for i in range(n):
    print("The counter’s value", i)
    total += i
    print("Subtotal", total)
print("The total of all numbers:", total)
```

WHEN TO USE FOR LOOP

- A for loop is used when some piece of code to be run multiple times, it is known how many times before the start of the loop.

Task 1. "Bacteria" - 0.25 point

The bacterium divides into two within 1 minute. At the beginning, there are n of bacteria. Write a program for calculating the number of bacteria after t minutes.

- Input: Two integers n and t
- Output: The number of bacteria after t minutes.

What is code and trace table for this task?

TASK 2 – 0,25 POINT

Write a program which can compute the factorial of a given numbers.
The results should be printed in a comma-separated sequence on a single line.
Suppose the following input is supplied to the program:
5
Then, the output should be:
1, 2, 6, 24, 120

TASK 3-4 – 0,5 POINT

1. Given natural numbers from 10 to N. Print odd multiples of five.
2. Print the squares of numbers from 11 to 99.

TASK - 2 FOR ADVANCED

1. Create a program that displays the multiplication table for a given number from 1 to 10 using a for loop.
2. Write a program that calculates the sum of all numbers from 1 to 100 using a for loop.
3. Create a program that finds the average value of a list of numbers using a for loop.
4. Write a program that finds the smallest element in a list of numbers using a for loop.
5. Create a program that prints all even numbers from 1 to 20 using a for loop.
6. Write a program that prints all prime numbers from 1 to 50 using a for loop.
7. Create a program that calculates the factorial of a given number using a for loop.
8. Write a program that calculates the sum of squares of numbers from 1 to 10 using a for loop.
9. Create a program that reverses a string using a for loop.
10. Write a program that finds all divisors of a given number using a for loop.
11. Create a program that checks if a given number is a palindrome (reads the same forwards and backwards) using a for loop.
12. Write a program that calculates the sum of all digits in a given number using a for loop.
13. Create a program that checks if a given number is prime using a for loop.
14. Write a program that generates the Fibonacci sequence up to a specified number of terms using a for loop.

TASK - 3 FOR ADVANCED

1. Write a program that prints all even numbers from 1 to 50 using a for loop.
2. Create a program that calculates the sum of all numbers from 1 to 1000 that are divisible by 7 using a for loop.
3. Write a program that displays a table of powers of 2 from 1 to 10 using a for loop.
4. Develop a program that calculates the average value of numbers in a list, excluding the minimum and maximum values.
5. Write a program that finds and prints all prime numbers within a specified range using a for loop.
6. Create a program that calculates and displays the sum of all digits in a user-entered number.
7. Write a program that prints all numbers within a specified range that are divisible by a given number using a for loop.
8. Develop a program that finds the greatest common divisor (GCD) of two numbers using the Euclidean algorithm and a for loop.
9. Write a program that prints numbers from 1 to 100, but replaces numbers divisible by 3 with "Fizz" and numbers divisible by 5 with "Buzz."
10. Create a program that finds the least common multiple (LCM) of two numbers using a for loop.
11. Develop a program that checks whether a given number is a palindrome, ignoring spaces and punctuation.
12. Write a program that finds and prints all Armstrong numbers within a specified range. (An Armstrong number is a number whose sum of cubes of its digits is equal to the number itself).
13. Create a program that finds and prints the prime Fibonacci numbers within a specified range.
14. Develop a program that prints the first N numbers in the Fibonacci sequence using a for loop.
15. Write a program that finds and prints the largest and smallest digits of a user-entered number.

TASK - 4 FOR ADVANCED

1. Create a program that finds and prints all palindrome numbers within a specified range.
2. Develop a program that finds and prints all happy numbers within a specified range. (A happy number is a number whose sum of squares of its digits equals 1).
3. Write a program that finds and prints all rectangular numbers within a specified range. (A rectangular number is a number with a count of divisors that is a rectangular number itself).
4. Create a program that calculates the sum of all numbers that can be obtained by multiplying the digits in a number, e.g., 123 = 1 * 2 * 3 = 6.
5. Develop a program that alternately prints "+" and "-" signs in a sequence from 1 to N.
6. Write a program that finds and prints the largest and smallest prime numbers within a specified range.
7. Create a program that prints numbers from 1 to N, replacing numbers divisible by 3 with "Fizz," numbers divisible by 5 with "Buzz," and numbers divisible by both 3 and 5 with "FizzBuzz."
8. Develop a program that calculates and prints the sum of squares of odd numbers from 1 to N.
9. Write a program that finds and prints all perfect numbers within a specified range. (A perfect number is a number where the sum of its divisors, excluding itself, equals itself).
10. Create a program that finds and prints all round numbers within a specified range. (A round number is a number where all its digits are the same).
11. Develop a program that finds and prints all Pythagorean triplets within a specified range. (A Pythagorean triplet is a set of three integers that can form the sides of a right triangle).
12. Write a program that prints the largest and smallest powers of two within a specified range.
13. Create a program that prints all twin prime numbers within a specified range. (Twin prime numbers are pairs of prime numbers that differ by two).
14. Develop a program that finds and prints all numbers that are both palindromes and prime within a specified range.
15. Write a program that finds and prints all numbers that can be expressed as the sum of cubes of two other numbers within a specified range.