

Artificial Intelligence & Machine Learning
Introduction to Virtual Lab
Experiment No. 13
(Analysis of Arithmetic Operations)

Arithmetic Operations

Aim: Write a Program to understand basics of Arithmetic Operations used in Python programming Language with the help of iterative simulator.

Theory:

An operator is a symbol that tells the compiler that either a mathematical or a logical manipulation has to be done. In this lab you will be studying about the Arithmetic Operations.

They are of the following types :

Addition Operator (+)

The addition operator is used to add two numbers. It is placed between two numbers that are to be added.

Syntax : number1 + number2

Program:

```
x = 3
y = 2
print('x + y =', x + y )
```

Output: x

+ y = 5

Subtraction Operator (-)

The subtraction operator is used to subtract two numbers. It is placed between two numbers that are to be subtracted. The right placed number is subtracted from the one that is placed at left. Syntax :

number1 - number2

Program:

```
x = 3
y = 2
print('x - y =', x - y )
```

Output: x

- y = 1

Multiplication Operator (*)

The multiplication operator is used to multiply two numbers. It is also placed between the two numbers that are to be operated.

Syntax : number1 * number2

Program:

```
x = 30
y = 10
print('x * y =', x * y )
```

Output: x *

y = 300

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Division Operator (/)

The division operator is used to divide two numbers. It is used between the numbers that are to be operated.

Syntax : number1 / number2

It has some different rules that have to be kept in mind before operating the numbers. Python2 operates the division operator by taking the integral value.

Example : 6 / 4

Answer : This operation will be solved in Python2 by taking the integral value i.e 1. Therefore, the answer of $6 / 4 = 1$

This problem can be taken care by Type Casting. Type Casting is used to convert the output in a desired form.

To get the correct answer of the above example, we will type cast it using float data type.

Program:

```
x = 30
y = 10
print('x / y =', x / y )
```

Output: x/y
= 3.0

Example : float(6 / 4)

Answer : Now, the output will be changed into float type and the answer will be 1.5.

float(6 / 4) = 1.5

There's another way of solving such problem. By using one float type input, we can get the desired answer. Example : 6.0 / 4

Answer : 1.5

Procedure:

Steps of simulator :

1. Read the simulator details.
2. Enter the values you want to operate.
3. Select the desired type of operation from the operations list.
4. Press CALCULATE to proceed.
5. Press NEXT to see the execution of the code.
6. Relevant line in the code will be highlighted.
7. The local variables will be shown in the Output Panel with their values.

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Simulation:

I. Addition:

Problem?	Step Execute	Result
<div>Addition</div> <div>12</div> <div>12</div> <div>Start</div> <div>Next</div> <div>Reset</div>	<pre>a = Input('Enter a Number') b = Input('Enter a Number') c = a + b print("The Addition is :",c)</pre>	<div>a: 12</div> <div>b: 12</div> <div>c: 24</div> <div>Output:</div> <div>The Addition is: 24</div>

II. Subtraction:

Problem?	Step Execute	Result
<div>Subtraction</div> <div>12</div> <div>5</div> <div>Start</div> <div>Next</div> <div>Reset</div>	<pre>a = Input('Enter a Number') b = Input('Enter a Number') c = a - b print("The Subtraction is :",c)</pre>	<div>a: 12</div> <div>b: 5</div> <div>c: 7</div> <div>Output:</div> <div>The Subtraction is: 7</div>

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III. Multiplication:

Problem?	Step Execute	Result
<div>Multiplication</div> <div>5</div> <div>7</div> <div>Start</div> <div>Next</div> <div>Reset</div>	<pre>a = Input('Enter a Number') b = Input('Enter a Number') c = a * b print("The Multiplication is :",c)</pre>	<div>a : 5</div> <div>b : 7</div> <div>c : 35</div> <div>Output :</div> <div>The Multiplication is : 35</div>

IV. Division:

Problem?	Step Execute	Result
<div>Division</div> <div>50</div> <div>2</div> <div>Start</div> <div>Next</div> <div>Reset</div>	<pre>a = Input('Enter a Number') b = Input('Enter a Number') c = a / b print("The Division is :",c)</pre>	<div>a : 50</div> <div>b : 2</div> <div>c : 25</div> <div>Output :</div> <div>The Division is : 25</div>

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Program on Jupyterlab :

```
In [1]: import numpy as Tnput
a=12
b=12
c = a + b

print("The Addition is :",c)

The Addition is : 24
```

```
In [4]: import numpy as Tnput
a=12
b=10
c = a - b

print("The Subtraction is :",c)

The Subtraction is : 2
```

```
In [5]: import numpy as Tnput
a=12
b=3
c = a * b

print("The Multiplication is :",c)

The Multiplication is : 36
```

```
In [6]: import numpy as Tnput
a=12
b=12
c = a / b

print("The Division is :",c)

The Division is : 1.0
```

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Introduction to Virtual Lab
Experiment No. 14
(Loops: Analysis of Factorial)

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Loops

Aim: Write a program to understand the flow of controls and types of loops used in Python programming language with the help of a iterative simulator.

Theory:

The execution of programming language codes is done by a compiler. A compiler is given a set of codes or rather a sequence of codes that perform a desired task. The task may or may not be repetitive but the compiler is smart enough to process it. Such repetitive code is known as a 'loop'.

Loop is a sequential set of instructions which gets executed multiple times to reduce minimize the repetition of code.

In Python, we have two types of loops :

i. for loop ii. while loop

To understand the functioning and flow of a loop, you must get familiar with the term 'block'. A block is the smallest unit in a loop which performs one particular task.

'For' loop :

Syntax :

for object in range(initialization, limit, update):
statements

The above given syntax is of for loop where we put the object name after 'for' and the limit inside 'range() '.

Program:

```
# Python program to illustrate  
# Iterating over range 0 to n-1  
  
n = 4  
for i in range(0, n):  
    print(i)
```

Output :

0
1
2
3
4

'While' loop :

Syntax :

while expression:
statements

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The above statement is for while loop, where the testing condition is placed after while and it is followed by the statements placed in the loop body.

Program:

```
# Python program to illustrate
# while loop
count = 0
while (count < 3):
    count = count + 1
    print("Hello people")
```

Output:

Hello people
Hello people
Hello people

Program:

```
# Python program to illustrate
# Single statement while block
count = 0
while (count == 0): print("Hello Geek")
```

Output:

hello geek hello
geek
.....

Nested loops :

A nested loop is an inner loop in the loop body of the outer loop. The inner or outer loop can be any type, such as a while loop or for loop. For example, the outer for loop can contain a while loop and vice versa

Program:

```
# Python program to illustrate
# nested for loops in Python
for i in range(1, 5):
    for j in range(i):
        print(i, end=' ')
    print()
```

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Output: 1

2 2

3 3 3

4 4 4 4

Program:

```
i=1
while i<=2 :
    print(i,"Outer loop is executed only once")
    j=1
    while j<=2:
        print(j,"Inner loop is executed until to completion")
        j+=1
    i+=1;
```

Output:

1 Outer loop is executed only once
1 Inner loop is executed until to completion
2 Inner loop is executed until to completion
2 Outer loop is executed only once
1 Inner loop is executed until to completion
2 Inner loop is executed until to completion

Procedure:

Steps of simulator :

1. Read the simulator details.
2. Enter the values you want to proceed with.
3. Press CALCULATE to proceed.
4. The code will be displayed.
5. Press NEXT to see the execution of code.
6. Relevant line in the code will be highlighted.
7. The local variables will be shown in the Output Panel with their values.

Simulation:

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Problem?	Step Execute	Result
<ul style="list-style-type: none">To find the Factorial of a Number. <div>12</div> <div><div>Submit</div><div>Start</div><div>Reset</div></div>	<pre>for num in range(start, end + 1): factorial = 1 if num < 0: print("Factorial for negative numbers does not exist!!!") elif num == 0: print("The Factorial of the Number is :") else: for i in range(1,num + 1): factorial = factorial*i print(The Factorial of the Number is :;num)</pre>	<p>The Factorial of the Number is :</p> <p>479001600</p>

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Experiment No. 15
(Analysis of String)

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Strings

Aim: Write a program to understand the concepts of string in Python programming language and to implement the operations that can be performed in a string.

Theory:

We can access a string using indexing. In a string each character is assigned with a unique index value which starts from 0. A string can be written in both single quotes and double quotes. Example : 'Hello World'

"Hello World"

Program:

```
print("Hello")
print('Hello')
```

Output:

Hello
Hello

Program

```
a = "Hello"
print(a)
```

Output

Hello

Program

```
# Multiline string to a variable by using three quotes
a = """Lorem ipsum dolor sit amet,
consectetur adipiscing elit,
sed do eiusmod tempor incididunt
ut labore et dolore magna aliqua."""
print(a)
```

Output

Lorem ipsum dolor sit amet,
consectetur adipiscing elit, sed do
eiusmod tempor incididunt ut
labore et dolore magna aliqua.

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Python allows negative indexing as well.

Example : -1, -3, -5.

Where -1 refers to the last index, -2 refers to second last index and so on.

Printing here can be done by placing the string in single or double quotes after print.

```
print("Hello World")
```

Concatenation

A string in python is immutable i.e. it can not be changed once defined. But concatenation is still possible

Program

```
s = 'Hello World'
s = s + "Example"

print(s)
```

Output

Hello WorldExample

Using Join() method also we can concatenate string

Program

```
var1 = "Hello"
var2 = "World"

# join() method is used to combine the strings
print("".join([var1, var2]))
```

Output

HelloWorld

Program

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```
# join() method is used here to combine  
# the string with a separator Space(" ")  
var1 = "Hello"  
var2 = "World"  
var3 = " ".join([var1, var2])  
  
print(var3)
```

Output

HelloWorld

Repetition

This is a unique property of strings in Python programming language. When a string is multiplied with an integer, the characters of string are multiplied the same number of times.

Syntax : string * integer

Program

```
s="k"  
s=s * 5  
print(s)
```

Solution

kkkkk

Slicing

Slicing is done in Python to select or display the desired number of characters in a string. It is done with the help of symbol ':'

Syntax : String[index:]

Program

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```
s="Hello World"
s = s[2:]
print(s)
```

Solution

llo World

All the characters from and after second index is selected

Program

```
s="Hello World"
s = s[1:8]
print(s)
```

Solution

ello Wo

Characters between index number 1 and 8 are selected

Length of a string can be calculated using the len function.

Syntax : len("string")
len("Hello World" It
will return 11.

Deleting / updating from a String:

In Python, Updation or deletion of characters from a String is not allowed. This will cause an error because item assignment or item deletion from a String is not supported

Program

```
String1 = "Hello, I'm a coder"
print("Initial String: ")
print(String1)

# Updating a character
# of the String
String1[2] = 'p'
print("\nUpdating character at 2nd Index: ")
print(String1)
```


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Output

Initial String:

Hello, I'm a coder

Traceback (most recent call last):

File "e:\VLAB\python\programs\a.py", line 51, in

String1[2] = 'p'

TypeError: 'str' object does not support item assignment **Procedure:**

Steps of simulator

1. Select the problem.
2. Read the simulator details.
3. Enter the desired input you want to operate.
4. Press CALCULATE to proceed.
5. The code will be displayed
6. Press NEXT to see the execution of code.
7. Relevant line in the code will be highlighted.
8. The local variables will be shown in the Output Panel with their values.

Simulation:

a) Index

Demonstration	Step Execute	Result
<p>Demonstrate the position of a character by defining proper index.</p> <p>Hello World</p> <p>6</p> <p>Start</p> <p>Next</p> <p>Reset</p>	<pre>s = input("Enter the String :") start = input("Starting Index :") print("The Indexed String is :",s[start])</pre>	<p>The Indexed String is :</p> <p>W</p>

b) Concatenate:

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Demonstration	Step Execute	Result
<p>Demonstrate how strings concatenate with each other.</p> <input type="text" value="Shrudhi"/> <input type="text" value="babu"/> <input type="text" value="vettiyattil"/> <input type="button" value="Start"/> <input type="button" value="Next"/> <input type="button" value="Reset"/>	<pre>s = input("Enter the String :") s1 = input("Enter a String :") s2 = input("[Optional]Enter a String :") print(s + s1) print(s + s1 + s2)</pre>	<p>The Concatenated String is :</p> <p>Shrudhi babu vettiyattil</p>

c) Slicing:

Demonstration	Step Execute	Result
<p>Demonstrate the working of slicing the strings.</p> <input type="text" value="Shrudhi"/> <input type="text" value="1"/> <input type="text" value="5"/> <input type="button" value="Start"/> <input type="button" value="Next"/> <input type="button" value="Reset"/>	<pre>s = input("Enter the String :") start = input("Starting Index :") end = input("Ending Index :") print(s[start:end])</pre>	<p>The Sliced String is :</p> <p>hrud</p>

d) Reverse:

Demonstration	Step Execute	Result
<p>Demonstrate how string reverse.</p> <input type="text" value="Shrudhi"/> <input type="button" value="Start"/> <input type="button" value="Next"/> <input type="button" value="Reset"/>	<pre>s = input("Enter the String :") print(s[::-1])</pre>	<p>The Reversed String is :</p> <p>ihdurhS</p>

e) String repeat:

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Demonstration	Step Execute	Result
Demonstrate how string repeat.	<pre>s = input("Enter the String :") n = input("Enter the Integer :") print(s*n)</pre>	The Repeated String is : Riya Riya Riya Riya Riya Riya
<div><input type="text" value="Riya"/></div> <div><input type="text" value="6"/></div> <div><input type="button" value="Start"/></div> <div><input type="button" value="Next"/> <input type="button" value="Reset"/></div>		

Program on Jupiter:

```
In [1]: s = 'Riya'
        start = 1
        print("The Indexed String is :",s[start])
The Indexed String is : i
```

```
In [2]: s = 'Riya'
        s1 = 'Lisha'
        print(s + s1)
RiyaLisha
```

```
In [3]: start = 0
        end = 2
        print(s[start:end])
Ri
```

```
In [4]: print(s[::-1])
ayIR
```

```
In [6]: n = 3
        print(s*n)
RiyaRiyaRiya
```