

Programming with Python - Open Elective

Python DataTypes:

int: integers e.g. 12, -100, 20 etc

Float: Real values e.g. 7.5, -1.2 etc

Boolean: True, False

str: string e.g. 'hello world'

(use 'type' function to identify datatype)

```
print(type(5))
```

```
<class 'int'>
```

```
print(type(3>5))
```

```
<class 'bool'>
```

```
print(type('Hello World!'))
```

```
<class 'str'>
```

```
print(type(3.14))
```

```
<class 'float'>
```

Relational Operators:

Used for comparing two expressions and yield True or False

==, !=, <, >, <=, >=

- Strings are compared left to right, characters by characters, based on ASCII codes.

ASCII code range:

'A' - 'Z' [65-90]

'a' - 'z' [97-122]

'0' - '9' [48-57]

$[0-9] < [A-Z] < [a-z]$

- If a string is a prefix of another string, the longer string is considered longer.

Logical Operators

(in order of precedence/priority)

not,

and,

or

Overall Order of precedence: Arithmetic operators > Relational Operators > Logical Operators

Arithmetic operators: **, *, /, //, **, %, +, -

Apply parenthesis to the following expressions and evaluate”

a. $12 / 4 + 5 * 3$

b. $10 - 4 / 2 + 6$

c. $3 < 5$ and $10 > 2 + 1$

d. $4 + 3 > 5$ and $2 < 8$ or $7 == 7$

e. not $3 + 2 > 4$ or $6 * 2 < 10$

f. $10 / 2 + 5 == 10$ and $3 > 1$

g. True or False and $5 > 3 + 2$

h. not $9 == 8$ and $7+1!=8$ or $6 < 4.5$

i. $7 ** 2 // 9 \% 3$

j. $5 \% 10 + 10 - 25 * 8 // 5$

k. $10!=9$ and $29 >= 29$ and 'hi' > 'hello' or 'bye' < 'Bye' and $7 <= 2.5$

l. $7 ** 2 // 4+5 > 8$ or $5!=6$

Control Structures (if else)

Programs for real life problems often require non-sequential and repetitive execution of instructions. Python provides control structures to achieve non-sequential execution and repetitive executions using constructs such as 'if-else', 'for', and 'while'

if Conditional Statement: used for selecting the next set of instructions to be executed based on condition(s).

Some common forms of 'if' Conditional

1. if < condition >:
 < Sequence of statements to be executed >

Note: *notice the placement of ':' and the space (indentation) before the statements to be executed if condition is True.*

2. if <condition >:
 < Sequence of statements to be executed >
 else:
 < Sequence of statements to be executed >

3. if <condition 1 > :
 < Sequence of statements to be executed >
 elif <condition 2> :
 < Sequence of statements to be executed >
 elif <condition 3> :
 < Sequence of statements to be executed >
 .
 .
 else:
 < Sequence of statements to be executed >

There can be different patterns (other than mentioned above) in which if-else is used..

Exercises

1. Write a program to input marks obtained from a student and assign grade 'A' or 'B' based on the marks obtained.
2. Write a program that takes a **pH value** as input and classifies the solution as **acidic, neutral, or basic**.
3. Write a program that asks whether an organism eats **plants, animals, or both** and classifies it as **herbivore, carnivore, or omnivore**.

```
Hint: diet = input("Does the organism eat  
plants, animals, or both? ")
```

4. Write a program that asks the user for a temperature in Celsius and determines whether water is in solid, liquid, or gas form.

```
Hint: temp = eval(input("Enter the temperature  
in Celsius: "))
```

5. Write a Python program that asks the user to enter their annual income and then determines their tax rate based on the following tax brackets:

- Income \leq Rs 10000 \rightarrow 0% tax
- Income Rs 10,001 - Rs30,000 \rightarrow 10% tax
- Income Rs 30,001 - Rs70,000 \rightarrow 20% tax
- Income Rs 70,001+ \rightarrow 30% tax

Print the tax rate and the total tax amount.

6. Write a Python program that calculates a person's **Body Mass Index (BMI)** and categorizes it based on the following scale:

- **BMI < 18.5** → Underweight
- **18.5 ≤ BMI < 24.9** → Normal weight
- **25.0 ≤ BMI < 29.9** → Overweight
- **BMI ≥ 30.0** → Obese

$$BMI = \frac{\{Weight\}}{Height(m)^2}$$

Ask the user to enter their weight (kg) and height (m).

Display the BMI value and the corresponding category

7. (Note: Try it yourself without external help. We will also do it in the class.)

Write a program that checks whether a given year is a **leap year** (divisible by 4, but not by 100 unless also divisible by 400).

8. Write a program that takes coefficients **a**, **b**, and **c** of a quadratic equation $ax^2+bx+c=0$ and determines the nature of its roots.

Hint: `discriminant = b**2 - 4*a*c`