

Python is a most popular high level general programming language.

Variables:

Variables are the reserved memory location to store the value we declare a identifier then equals sign then the value we want for our variable

Rules for declaring variable

1. A variable name must start with a letter or the underscore character
2. A variable name cannot start with a number
3. A variable name can only contain alpha-numeric characters and underscores (A-z, 0-9, and _)
4. Variable names are case-sensitive (age, Age and AGE are three different variables)

User Input

Receiving input from the user. To obtain data or send data we need to communicate with the user. Input() function is used to take the user input. Python determines automatically if the number is integer string or a list. By default, data from the user is stored as string.

Data Types

Python has the following data type

1. None
2. Numeric
3. String
4. List
5. Tuple
6. Set
7. Dictionary(Map)

Difference between mutable and non-mutable data type in python:

a. Mutable Data Types:

Mutable data types are those data types in which the value assigned to a variable can be change. It is used when there is need to change the size of the data object.

Some of the mutable data types:

1. Lists
2. Dictionaries
3. Sets

b. Immutable data types

Immutable data types are those data types in which the value assigned to a variable cannot be change. Size of the immutable data type is fixed.

Some immutable data types:

1. Integers
2. Float
3. Booleans
4. Strings
5. Tuples

To find the datatype we have the built in function `type()`

1. **None:** We have a variable with no value allocated then it is none which is called null in other language.
2. **Numbers:** We have three types of number
 - a. Integer: Positive or negative numbers without decimal values. There is no limit for the integer precision, but are limited by available memory size.
 - b. Float: Positive or negative numbers including decimal values
 - c. Complex: Combination of real part "x" and imaginary part "y" written in the form of $x+yi$

String: Created by adding single or double quote. Triple quotes string are useful when the content of the string literal span multiple line of codes.

Slicing: We can use operator `[]` with string. String are stored sequences of character indexed by integer, starting at zero. To extract a single character, use the indexing operators `[i]`

Concatenation: String in python can be concatenated using `+` operator as shown in the code.

To perform numerical operation string data types must be converted into numbers using `int` and `float` function.

We can convert non string data into string by using `str()` or `repr()`

Formatted string: Formatted string in python is used to generate dynamic text from the variables. The curly bracket in formatted string defines place holders and when we run code, this place holder gets filled with values of previously defined variables.

List: List are the sequence of arbitrary object enclosed by square brackets. List are ordered and changeable, separated by commas, and consist of a number of compound data typed. List are mutable type, i.e. it is possible to change their content. List is similar to array in other programming language. Use to group numbers or string

List are:

1. **Dynamically sized:** Specifying the size of the list is not required and they can be expanded.
2. **Heterogeneous:** List in python can contain any data element and contain any mixture of the data types
3. **Ordered:** Python list are order as specified and we can access their elements in one after another.

Slicing: We can also use slicing operator with the list. List stores sequences indexed by integer, starting at zero . To extract exact item, we use operator `s[i]`.

Method	Function	Example
<code>append()</code>	Add elements to the end of the list and the length of the list is increase by one	<code>a.append(6)</code>
<code>Insert()</code>	Append add elements at the end whereas insert adds at a given index Syntax: <code>listname.insert(index, item)</code>	<code>a.insert(4,6)</code>
<code>extend()</code>	Extend a list by appending elements from an iterable	<code>a.extend(1)</code>
<code>remove()</code>	Removes the element which you want to	<code>a.remove(2)</code>
<code>clear()</code>	Removes all the element from the list and returns empty	<code>a.clear()</code>
<code>sort()</code>	Sort the elements of given list in a specific order that may be ascending or descending	<code>a.sort()</code> <code>a.sort(reverse=True)#</code> descending

2D List:

2D list refers to a rectangular data table which generally defined as matrices or two dimensional array we use `,` between two list to make an array.

Difference between List and Array

List	Array
Can have elements of different data type	Can't have element of different type.
Can't directly handle arithmetic operation	Can directly handle arithmetic operation
Supports negative indexing	Does not support negative indexing
Preferred for short sequence of data	Preferred for long sequence of data

1D vs 2D vs nd array

1D array	2D array	nd array
List of the variable of similar data types	List of list of variable of same data type	An nd array is a multidimensional container of items of the same type and size.
It can represent multiple data items	Represents multiple data items as the table consisting of rows and columns	The number of dimensions and items in an array is defined by its shape, which is a tuple of N non-negative integer that specify the size of each dimension.
<code>array([0,0])</code>	<code>array([[0,0],[1,1]])</code>	<code>array([[[0,0],[0,0]],[[0,0],[0,0]]])</code>