

PYTHON PROGRAMMING

[R17A0554]

LECTURE NOTES

B.TECH III YEAR – II SEM (R17)
(2019-20)



DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

**MALLA REDDY COLLEGE OF ENGINEERING &
TECHNOLOGY**

(Autonomous Institution – UGC, Govt. of India)

Recognized under 2(f) and 12 (B) of UGC ACT 1956

(Affiliated to JNTUH, Hyderabad, Approved by AICTE - Accredited by NBA & NAAC – ‘A’ Grade - ISO 9001:2015 Certified)

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SYLLABUS

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

III Year B. Tech CSE -II SEM

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OPEN ELECTIVE III (R17A0554) PYTHON PROGRAMMING

OBJECTIVES:

- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I

INTRODUCTION DATA, EXPRESSIONS, STATEMENTS

Introduction to Python and installation, data types: Int, float, Boolean, string, and list; variables, expressions, statements, precedence of operators, comments; modules, functions--- function and its use, flow of execution, parameters and arguments.

UNIT II

CONTROL FLOW, LOOPS

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: while, for, break, continue.

UNIT III

FUNCTIONS, ARRAYS

Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Python arrays, Access the Elements of an Array, array methods.

UNIT IV

LISTS, TUPLES, DICTIONARIES

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, list comprehension; Tuples: tuple assignment, tuple as return value, tuple comprehension; Dictionaries: operations and methods, comprehension;

UNIT V

FILES, EXCEPTIONS, MODULES, PACKAGES

Files and exception: text files, reading and writing files, command line arguments, errors and exceptions, handling exceptions, modules (datetime, time, OS , calendar, math module), Explore packages.

OUTCOMES: Upon completion of the course, students will be able to

- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs

TEXT BOOKS

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist``, 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. R. Nageswara Rao, "Core Python Programming", dreamtech
3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson

REFERENCE BOOKS:

1. Core Python Programming, W.Chun, Pearson.
2. Introduction to Python, Kenneth A. Lambert, Cengage
3. Learning Python, Mark Lutz, Orielly

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INTRODUCTION DATA, EXPRESSIONS, STATEMENTS

Introduction to Python and installation, data types: Int, float, Boolean, string, and list; variables, expressions, statements, precedence of operators, comments; modules, functions--
- function and its use, flow of execution, parameters and arguments.

Introduction to Python and installation:

Python is a widely used general-purpose, high level programming language. It was initially designed by **Guido van Rossum in 1991** and developed by Python Software Foundation. It was mainly developed for emphasis on code readability, and its syntax allows programmers to express concepts in fewer lines of code.

Python is a programming language that lets you work quickly and integrate systems more efficiently.

There are two major Python versions- **Python 2 and Python 3**.

- On 16 October 2000, Python 2.0 was released with many new features.
- On 3rd December 2008, Python 3.0 was released with more testing and includes new features.

Beginning with Python programming:

1) Finding an Interpreter:

Before we start Python programming, we need to have an interpreter to interpret and run our programs. There are certain online interpreters like <https://ide.geeksforgeeks.org/>, <http://ideone.com/> or <http://codepad.org/> that can be used to start Python without installing an interpreter.

Windows: There are many interpreters available freely to run Python scripts like IDLE (Integrated Development Environment) which is installed when you install the python software from <http://python.org/downloads/>

2) Writing first program:

```
# Script Begins
```

```
Statement1
```

Statement2

Statement3

Script Ends

Differences between scripting language and programming language:

SCRIPTING LANGUAGE	PROGRAMMING LANGUAGE
A programming language that supports scripts: programs written for a special run-time environment that automate the execution of tasks	A formal language, which comprises a set of instructions used to produce various kinds of output
Execution speed is slow	Compiler-based languages are executed much faster while interpreter-based languages are executed slower
Can be divided into client-side scripting languages and server-side scripting languages	Can be divided into high-level, low-level languages or compiler-based or interpreter-based languages
Easier to learn	Not as easy to learn
Ex: JavaScript, Perl, PHP, Python and Ruby	Ex: C, C++, and Assembly
Mostly used for web development	Used to develop various applications such as desktop, web, mobile, etc.

Why to use Python:

The following are the primary factors to use python in day-to-day life:

1. Python is object-oriented

Structure supports such concepts as polymorphism, operation overloading and multiple inheritance.

2. Indentation

Indentation is one of the greatest feature in python

3. It's free (open source)

Downloading python and installing python is free and easy

4. It's Powerful

- Dynamic typing
- Built-in types and tools
- Library utilities
- Third party utilities (e.g. Numeric, NumPy, sciPy)
- Automatic memory management

5. It's Portable

- Python runs virtually every major platform used today
- As long as you have a compatible python interpreter installed, python programs will run in exactly the same manner, irrespective of platform.

6. It's easy to use and learn

- No intermediate compile
- Python Programs are compiled automatically to an intermediate form called byte code, which the interpreter then reads.
- This gives python the development speed of an interpreter without the performance loss inherent in purely interpreted languages.
- Structure and syntax are pretty intuitive and easy to grasp.

7. Interpreted Language

Python is processed at runtime by python Interpreter

8. Interactive Programming Language

Users can interact with the python interpreter directly for writing the programs

9. Straight forward syntax

The formation of python syntax is simple and straight forward which also makes it popular.

Installation:

There are many interpreters available freely to run Python scripts like IDLE (Integrated Development Environment) which is installed when you install the python software from <http://python.org/downloads/>

Steps to be followed and remembered:

- Step 1: Select Version of Python to Install.
- Step 2: Download Python Executable Installer.
- Step 3: Run Executable Installer.
- Step 4: Verify Python Was Installed On Windows.

Step 5: Verify Pip Was Installed.

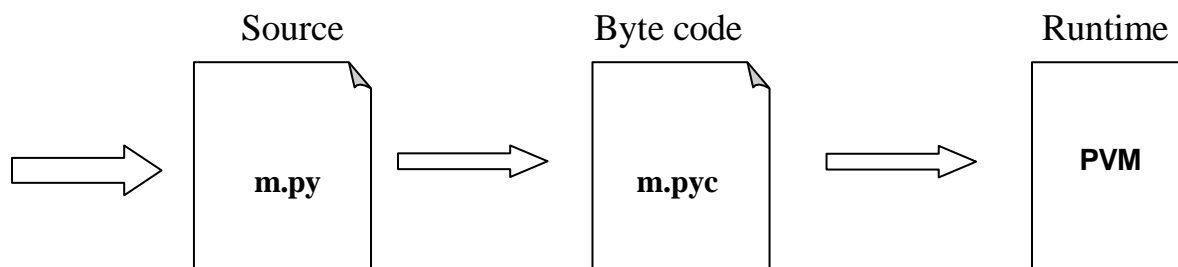
Step 6: Add Python Path to Environment Variables (Optional)



Working with Python

Python Code Execution:

Python's traditional runtime execution model: Source code you type is translated to byte code, which is then run by the Python Virtual Machine (PVM). Your code is automatically compiled, but then it is interpreted.



Source code extension is .py
Byte code extension is .pyc (Compiled python code)

There are two modes for using the Python interpreter:

- Interactive Mode
- Script Mode

Running Python in interactive mode:

Without passing python script file to the interpreter, directly execute code to Python prompt. Once you're inside the python interpreter, then you can start.

```
>>> print("hello world")
```

```
hello world
```

Relevant output is displayed on subsequent lines without the >>> symbol

```
>>> x=[0,1,2]
```

Quantities stored in memory are not displayed by default.

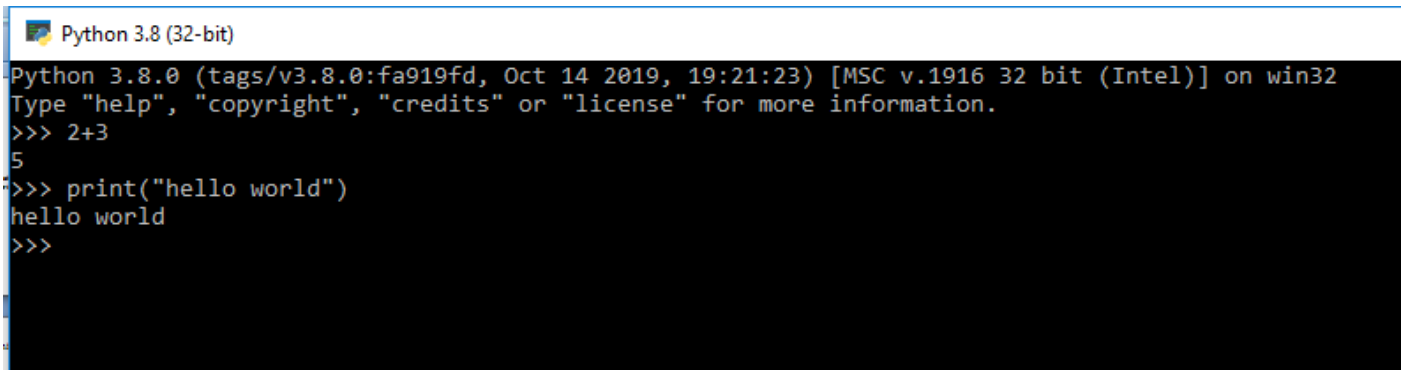
```
>>> x
```

#If a quantity is stored in memory, typing its name will display it.

```
[0, 1, 2]
```

```
>>> 2+3
```

```
5
```

A screenshot of a Python 3.8 (32-bit) interactive shell window. The window title is "Python 3.8 (32-bit)". The prompt "Python 3.8.0 (tags/v3.8.0:fa919fd, Oct 14 2019, 19:21:23) [MSC v.1916 32 bit (Intel)] on win32" is displayed. Below the prompt, the user enters "Type 'help', 'copyright', 'credits' or 'license' for more information." followed by the code: ">>> 2+3", "5", ">>> print('hello world')", "hello world", and ">>>".

```
Python 3.8 (32-bit)
Python 3.8.0 (tags/v3.8.0:fa919fd, Oct 14 2019, 19:21:23) [MSC v.1916 32 bit (Intel)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> 2+3
5
>>> print("hello world")
hello world
>>>
```

The chevron at the beginning of the 1st line, i.e., the symbol >>> is a prompt the python interpreter uses to indicate that it is ready. If the programmer types 2+6, the interpreter replies 8.

Running Python in script mode:

Alternatively, programmers can store Python script source code in a file with the .py extension, and use the interpreter to execute the contents of the file. To execute the script by the interpreter, you have to tell the interpreter the name of the file. For example, if you have a script name MyFile.py and you're working on Unix, to run the script you have to type:

```
python MyFile.py
```

Working with the interactive mode is better when Python programmers deal with small pieces of code as you can type and execute them immediately, but when the code is more than 2-4 lines, using the script for coding can help to modify and use the code in future.

Example:

```
C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\pyyy>python e1.py
resource open
the no cant be divisibile zero division by zero
resource close
finished
```

LISTS, TUPLES, DICTIONARIES

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, list comprehension; **Tuples:** tuple assignment, tuple as return value, tuple comprehension; **Dictionaries:** operations and methods, comprehension;

Lists, Tuples, Dictionaries:

List:

- It is a general purpose most widely used in data structures
- List is a collection which is ordered and changeable and allows duplicate members. (Grow and shrink as needed, sequence type, sortable).
- To use a list, you must declare it first. Do this using square brackets and separate values with commas.
- We can construct / create list in many ways.

Ex:

```
>>> list1=[1,2,3,'A','B',7,8,[10,11]]
```

```
>>> print(list1)
```

```
[1, 2, 3, 'A', 'B', 7, 8, [10, 11]]
```

```
>>> x=list()
```

```
>>> x
```

```
[]
```

```
>>> tuple1=(1,2,3,4)
```

```
>>> x=list(tuple1)
```

```
>>> x
```

```
[1, 2, 3, 4]
```

List operations:

These operations include indexing, slicing, adding, multiplying, and checking for membership

Basic List Operations:

Lists respond to the + and * operators much like strings; they mean concatenation and repetition here too, except that the result is a new list, not a string.

Python Expression	Results	Description
<code>len([1, 2, 3])</code>	3	Length
<code>[1, 2, 3] + [4, 5, 6]</code>	<code>[1, 2, 3, 4, 5, 6]</code>	Concatenation
<code>['Hi!'] * 4</code>	<code>['Hi!', 'Hi!', 'Hi!', 'Hi!']</code>	Repetition
<code>3 in [1, 2, 3]</code>	True	Membership
<code>for x in [1, 2, 3]: print x,</code>	1 2 3	Iteration

Indexing, Slicing, and Matrixes

Because lists are sequences, indexing and slicing work the same way for lists as they do for strings.

Assuming following input –

```
L = ['mrcet', 'college', 'MRCET!']
```

Python Expression	Results	Description
<code>L[2]</code>	MRCET	Offsets start at zero

L[-2]	college	Negative: count from the right
L[1:]	['college', 'MRCET!']	Slicing fetches sections

List slices:

```
>>> list1=range(1,6)
>>> list1
range(1, 6)
>>> print(list1)
range(1, 6)
>>> list1=[1,2,3,4,5,6,7,8,9,10]
>>> list1[1:]
[2, 3, 4, 5, 6, 7, 8, 9, 10]
>>> list1[:1]
[1]
>>> list1[2:5]
[3, 4, 5]
>>> list1[:6]
[1, 2, 3, 4, 5, 6]
>>> list1[1:2:4]
[2]
>>> list1[1:8:2]
[2, 4, 6, 8]
```

List methods:

The list data type has some more methods. Here are all of the methods of list objects:

- Del()

- Append()
- Extend()
- Insert()
- Pop()
- Remove()
- Reverse()
- Sort()

Delete: Delete a list or an item from a list

```
>>> x=[5,3,8,6]
>>> del(x[1])      #deletes the index position 1 in a list
>>> x
[5, 8, 6]
-----
>>> del(x)
>>> x              # complete list gets deleted
```

Append: Append an item to a list

```
>>> x=[1,5,8,4]
>>> x.append(10)
>>> x
[1, 5, 8, 4, 10]
```

Extend: Append a sequence to a list.

```
>>> x=[1,2,3,4]
>>> y=[3,6,9,1]
>>> x.extend(y)
>>> x
[1, 2, 3, 4, 3, 6, 9, 1]
```

Insert: To add an item at the specified index, use the insert () method:

```
>>> x=[1,2,4,6,7]
```

```
>>> x.insert(2,10) #insert(index no, item to be inserted)
```

```
>>> x
```

```
[1, 2, 10, 4, 6, 7]
```

```
-----  
>>> x.insert(4,['a',11])
```

```
>>> x
```

```
[1, 2, 10, 4, ['a', 11], 6, 7]
```

Pop: The pop() method removes the specified index, (or the last item if index is not specified) or simply pops the last item of list and returns the item.

```
>>> x=[1, 2, 10, 4, 6, 7]
```

```
>>> x.pop()
```

```
7
```

```
>>> x
```

```
[1, 2, 10, 4, 6]
```

```
-----  
>>> x=[1, 2, 10, 4, 6]
```

```
>>> x.pop(2)
```

```
10
```

```
>>> x
```

```
[1, 2, 4, 6]
```

Remove: The remove() method removes the specified item from a given list.

```
>>> x=[1,33,2,10,4,6]
```

```
>>> x.remove(33)
```

```
>>> x
```



```
[1, 2, 10, 4, 6]
```

```
>>> x.remove(4)
```

```
>>> x
```

```
[1, 2, 10, 6]
```

Reverse: Reverse the order of a given list.

```
>>> x=[1,2,3,4,5,6,7]
```

```
>>> x.reverse()
```

```
>>> x
```

```
[7, 6, 5, 4, 3, 2, 1]
```

Sort: Sorts the elements in ascending order

```
>>> x=[7, 6, 5, 4, 3, 2, 1]
```

```
>>> x.sort()
```

```
>>> x
```

```
[1, 2, 3, 4, 5, 6, 7]
```

```
-----
```

```
>>> x=[10,1,5,3,8,7]
```

```
>>> x.sort()
```

```
>>> x
```

```
[1, 3, 5, 7, 8, 10]
```

List loop:

Loops are control structures used to repeat a given section of code a certain number of times or until a particular condition is met.

Method #1: For loop

```
#list of items
```

```
list = ['M','R','C','E','T']
```

```
i = 1
```

```
#Iterating over the list
for item in list:
    print ('college ',i,' is ',item)
    i = i+1
```

Output:

```
C:/Users/MRCET/AppData/Local/Programs/Python/Python38-32/pyyy/lis.py
```

```
college 1 is M
college 2 is R
college 3 is C
college 4 is E
college 5 is T
```

Method #2: For loop and range()

In case we want to use the traditional for loop which iterates from number x to number y.

```
# Python3 code to iterate over a list
```

```
list = [1, 3, 5, 7, 9]
```

```
# getting length of list
```

```
length = len(list)
```

```
# Iterating the index
```

```
# same as 'for i in range(len(list))'
```

```
for i in range(length):
```

```
    print(list[i])
```

Output:

```
C:/Users/MRCET/AppData/Local/Programs/Python/Python38-32/pyyy/listloop.py
```

```
1
3
5
7
9
```

Method #3: using while loop

```
# Python3 code to iterate over a list
```

```
list = [1, 3, 5, 7, 9]
```

```
# Getting length of list
```

```
length = len(list)
i = 0
```

```
# Iterating using while loop
while i < length:
    print(list[i])
    i += 1
```

Mutability:

A mutable object can be changed after it is created, and an immutable object can't.

Append: Append an item to a list

```
>>> x=[1,5,8,4]
>>> x.append(10)
>>> x
[1, 5, 8, 4, 10]
```

Extend: Append a sequence to a list.

```
>>> x=[1,2,3,4]
>>> y=[3,6,9,1]
>>> x.extend(y)
>>> x
```

Delete: Delete a list or an item from a list

```
>>> x=[5,3,8,6]
>>> del(x[1])      #deletes the index position 1 in a list
>>> x
[5, 8, 6]
```

Insert: To add an item at the specified index, use the insert () method:

```
>>> x=[1,2,4,6,7]
>>> x.insert(2,10) #insert(index no, item to be inserted)
```

```
>>> x
```

```
[1, 2, 10, 4, 6, 7]
```

```
-----  
>>> x.insert(4,['a',11])
```

```
>>> x
```

```
[1, 2, 10, 4, ['a', 11], 6, 7]
```

Pop: The pop() method removes the specified index, (or the last item if index is not specified) or simply pops the last item of list and returns the item.

```
>>> x=[1, 2, 10, 4, 6, 7]
```

```
>>> x.pop()
```

```
7
```

```
>>> x
```

```
[1, 2, 10, 4, 6]
```

```
-----  
>>> x=[1, 2, 10, 4, 6]
```

```
>>> x.pop(2)
```

```
10
```

```
>>> x
```

```
[1, 2, 4, 6]
```

Remove: The remove() method removes the specified item from a given list.

```
>>> x=[1,33,2,10,4,6]
```

```
>>> x.remove(33)
```

```
>>> x
```

```
[1, 2, 10, 4, 6]
```

```
>>> x.remove(4)
```

```
>>> x
```

```
[1, 2, 10, 6]
```

Reverse: Reverse the order of a given list.

```
>>> x=[1,2,3,4,5,6,7]
```

```
>>> x.reverse()
```

```
>>> x
```

```
[7, 6, 5, 4, 3, 2, 1]
```

Sort: Sorts the elements in ascending order

```
>>> x=[7, 6, 5, 4, 3, 2, 1]
```

```
>>> x.sort()
```

```
>>> x
```

```
[1, 2, 3, 4, 5, 6, 7]
```

```
-----  
>>> x=[10,1,5,3,8,7]
```

```
>>> x.sort()
```

```
>>> x
```

```
[1, 3, 5, 7, 8, 10]
```

Aliasing:

1. An alias is a second name for a piece of data, often easier (and more useful) than making a copy.
2. If the data is immutable, aliases don't matter because the data can't change.
3. But if data can change, aliases can result in lot of hard – to – find bugs.
4. Aliasing happens whenever one variable's value is assigned to another variable.

For ex:

```
a = [81, 82, 83]
```

```
b = [81, 82, 83]
print(a == b)
print(a is b)
b = a
print(a == b)
print(a is b)
b[0] = 5
print(a)
```

Output:

```
C:/Users/MRCET/AppData/Local/Programs/Python/Python38-32/pyyy/alia.py
True
False
True
True
[5, 82, 83]
```

Because the same list has two different names, a and b, we say that it is **aliased**. Changes made with one alias affect the other. In the example above, you can see that a and b refer to the same list after executing the assignment statement `b = a`.

Cloning Lists:

If we want to modify a list and also keep a copy of the original, we need to be able to make a copy of the list itself, not just the reference. This process is sometimes called cloning, to avoid the ambiguity of the word copy.

The easiest way to clone a list is to use the slice operator. Taking any slice of a creates a new list. In this case the slice happens to consist of the whole list.

Example:

```
a = [81, 82, 83]
b = a[:]    # make a clone using slice
print(a == b)
print(a is b)
b[0] = 5
print(a)
print(b)
```

Output:

```
C:/Users/MRCET/AppData/Local/Programs/Python/Python38-32/pyyy/clo.py
```

```
True
```

```
False
```

```
[81, 82, 83]
```

```
[5, 82, 83]
```

```
Now we are free to make changes to b without worrying about a
```

List parameters:

Passing a list as an argument actually passes a reference to the list, not a copy of the list. Since lists are mutable, changes made to the elements referenced by the parameter change the same list that the argument is referencing.

for example, the function below takes a list as an argument and multiplies each element in the list by 2:

```
def doubleStuff(List):
```

```
    """ Overwrite each element in aList with double its value. """
```

```
    for position in range(len(List)):
```

```
        List[position] = 2 * List[position]
```

```
things = [2, 5, 9]
```

```
print(things)
```

```
doubleStuff(things)
```

```
print(things)
```

Output:

```
C:/Users/MRCET/AppData/Local/Programs/Python/Python38-32/lipar.py ==
```

```
[2, 5, 9]
```

```
[4, 10, 18]
```

List comprehension:**List:**

List comprehensions provide a concise way to create lists. Common applications are to make new lists where each element is the result of some operations applied to each member of another sequence or iterable, or to create a subsequence of those elements that satisfy a certain condition.

For example, assume we want to create a list of squares, like:

```
>>> list1=[]  
  
>>> for x in range(10):  
    list1.append(x**2)  
  
>>> list1  
[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

(or)

This is also equivalent to

```
>>> list1=list(map(lambda x:x**2, range(10)))  
  
>>> list1  
[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

(or)

Which is more concise and readable.

```
>>> list1=[x**2 for x in range(10)]  
  
>>> list1  
[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```


Similarly some examples:

```
>>> x=[m for m in range(8)]
```

```
>>> print(x)
```

```
[0, 1, 2, 3, 4, 5, 6, 7]
```

```
>>> x=[z**2 for z in range(10) if z>4]
```

```
>>> print(x)
```

```
[25, 36, 49, 64, 81]
```

```
>>> x=[x ** 2 for x in range (1, 11) if x % 2 == 1]
```

```
>>> print(x)
```

```
[1, 9, 25, 49, 81]
```

```
>>> a=5
```

```
>>> table = [[a, b, a * b] for b in range(1, 11)]
```

```
>>> for i in table:
```

```
    print(i)
```

```
[5, 1, 5]
```

```
[5, 2, 10]
```

```
[5, 3, 15]
```

```
[5, 4, 20]
```

```
[5, 5, 25]
```

```
[5, 6, 30]
```

```
[5, 7, 35]
```

```
[5, 8, 40]
```

```
[5, 9, 45]
```

```
[5, 10, 50]
```

Tuples:

A tuple is a collection which is ordered and unchangeable. In Python tuples are written with round brackets.

- Supports all operations for sequences.
- Immutable, but member objects may be mutable.
- If the contents of a list shouldn't change, use a tuple to prevent items from

accidentally being added, changed, or deleted.

- Tuples are more efficient than list due to python's implementation.

We can construct tuple in many ways:

```
X=() #no item tuple
```

```
X=(1,2,3)
```

```
X=tuple(list1)
```

```
X=1,2,3,4
```

Example:

```
>>> x=(1,2,3)
```

```
>>> print(x)
```

```
(1, 2, 3)
```

```
>>> x
```

```
(1, 2, 3)
```

```
-----  
>>> x=()
```

```
>>> x
```

```
()
```

```
-----  
>>> x=[4,5,66,9]
```

```
>>> y=tuple(x)
```

```
>>> y
```

```
(4, 5, 66, 9)
```

```
-----  
>>> x=1,2,3,4
```

```
>>> x
```

```
(1, 2, 3, 4)
```

Some of the operations of tuple are:

- Access tuple items
- Change tuple items
- Loop through a tuple
- Count()
- Index()
- Length()

Access tuple items: Access tuple items by referring to the index number, inside square brackets

```
>>> x=('a','b','c','g')
```

```
>>> print(x[2])
```

```
c
```

Change tuple items: Once a tuple is created, you cannot change its values. Tuples are unchangeable.

```
>>> x=(2,5,7,'4',8)
```

```
>>> x[1]=10
```

Traceback (most recent call last):

```
File "<pyshell#41>", line 1, in <module>
```

```
    x[1]=10
```

TypeError: 'tuple' object does not support item assignment

```
>>> x
```

```
(2, 5, 7, '4', 8) # the value is still the same
```

Loop through a tuple: We can loop the values of tuple using for loop

```
>>> x=4,5,6,7,2,'aa'
```

```
>>> for i in x:
```

```
    print(i)
```

```
4
```

```
5
```

```
6
```

```
7
```

```
2
```

```
aa
```

Count (): Returns the number of times a specified value occurs in a tuple

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
```

```
>>> x.count(2)
```

```
4
```

Index (): Searches the tuple for a specified value and returns the position of where it was found

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>> x.index(2)
1
```

(Or)

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>> y=x.index(2)
>>> print(y)
1
```

Length (): To know the number of items or values present in a tuple, we use len().

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>> y=len(x)
>>> print(y)
12
```

Tuple Assignment

Python has tuple assignment feature which enables you to assign more than one variable at a time. In here, we have assigned tuple 1 with the college information like college name, year, etc. and another tuple 2 with the values in it like number (1, 2, 3... 7).

For Example,

Here is the code,

- >>> tup1 = ('mrcet', 'eng college', '2004', 'cse', 'it', 'csit');
- >>> tup2 = (1, 2, 3, 4, 5, 6, 7);
- >>> print(tup1[0])
- mrcet
- >>> print(tup2[1:4])
- (2, 3, 4)

Tuple 1 includes list of information of mrcet

Tuple 2 includes list of numbers in it

We call the value for [0] in tuple and for tuple 2 we call the value between 1 and 4

Run the above code- It gives name mrcet for first tuple while for second tuple it gives number (2, 3, 4)

Tuple as return values:

A Tuple is a comma separated sequence of items. It is created with or without (). Tuples are immutable.

A Python program to return multiple values from a method using tuple

This function returns a tuple

```
def fun():  
    str = "mrcet college"  
    x = 20  
    return str, x; # Return tuple, we could also  
                # write (str, x)
```

Driver code to test above method

```
str, x = fun() # Assign returned tuple
```

```
print(str)
```

```
print(x)
```

Output:

```
C:/Users/MRCET/AppData/Local/Programs/Python/Python38-32/tupretval.py
```

```
mrcet college
```

```
20
```

- Functions can return tuples as return values.

```
def circleInfo(r):
```

```
    """ Return (circumference, area) of a circle of radius r """
```

```
    c = 2 * 3.14159 * r
```

```
    a = 3.14159 * r * r
```

```
    return (c, a)
```

```
print(circleInfo(10))
```

Output:

```
C:/Users/MRCET/AppData/Local/Programs/Python/Python38-32/functupretval.py
```

```
(62.8318, 314.159)
```

```
-----  
def f(x):  
    y0 = x + 1  
    y1 = x * 3  
    y2 = y0 ** y3  
    return (y0, y1, y2)
```

Tuple comprehension:

Tuple Comprehensions are special: The result of a tuple comprehension is special. You might expect it to produce a tuple, but what it does is produce a special "generator" object that we can iterate over.

For example:

```
>>> x = (i for i in 'abc') #tuple comprehension  
>>> x  
<generator object <genexpr> at 0x033EEC30>  
  
>>> print(x)  
<generator object <genexpr> at 0x033EEC30>
```

You might expect this to print as ('a', 'b', 'c') but it prints as <generator object <genexpr> at 0x02AAD710> The result of a tuple comprehension is not a tuple: it is actually a generator. The only thing that you need to know now about a generator now is that you can iterate over it, but ONLY ONCE.

So, given the code

```
>>> x = (i for i in 'abc')  
>>> for i in x:  
    print(i)
```

```
a  
b  
c
```

Create a list of 2-tuples like (number, square):

```
>>> z=[(x, x**2) for x in range(6)]  
>>> z  
[(0, 0), (1, 1), (2, 4), (3, 9), (4, 16), (5, 25)]
```

Set:

Similarly to list comprehensions, set comprehensions are also supported:

```
>>> a = {x for x in 'abracadabra' if x not in 'abc'}
```

```
>>> a
{'r', 'd'}
```

```
>>> x={3*x for x in range(10) if x>5}
```

```
>>> x
{24, 18, 27, 21}
```

Dictionaries:

A dictionary is a collection which is unordered, changeable and indexed. In Python dictionaries are written with curly brackets, and they have keys and values.

- Key-value pairs
- Unordered

We can construct or create dictionary like:

```
X={1:'A',2:'B',3:'c'}
```

```
X=dict([('a',3) ('b',4)])
```

```
X=dict('A'=1,'B' =2)
```

Example:

```
>>> dict1 = {"brand":"mrcet","model":"college","year":2004}
```

```
>>> dict1
```

```
{'brand': 'mrcet', 'model': 'college', 'year': 2004}
```

Operations and methods:

Methods that are available with dictionary are tabulated below. Some of them have already been used in the above examples.

Method	Description
clear()	Remove all items form the dictionary.

<code>copy()</code>	Return a shallow copy of the dictionary.
<code>fromkeys(seq[, v])</code>	Return a new dictionary with keys from seq and value equal to v (defaults to None).
<code>get(key[,d])</code>	Return the value of key. If key doesnot exit, return d (defaults to None).
<code>items()</code>	Return a new view of the dictionary's items (key, value).
<code>keys()</code>	Return a new view of the dictionary's keys.
<code>pop(key[,d])</code>	Remove the item with key and return its value or d if key is not found. If d is not provided and key is not found, raises <code>KeyError</code> .
<code>popitem()</code>	Remove and return an arbitrary item (key, value). Raises <code>KeyError</code> if the dictionary is empty.
<code>setdefault(key[,d])</code>	If key is in the dictionary, return its value. If not, insert key with a value of d and return d (defaults to None).
<code>update([other])</code>	Update the dictionary with the key/value pairs from other, overwriting existing keys.
<code>values()</code>	Return a new view of the dictionary's values

Below are some dictionary operations:

To access specific value of a dictionary, we must pass its key,

```
>>> dict1 = {"brand":"mrcet","model":"college","year":2004}
>>> x=dict1["brand"]
>>> x
'mrcet'
```

To access keys and values and items of dictionary:

```
>>> dict1 = {"brand":"mrcet","model":"college","year":2004}
>>> dict1.keys()
dict_keys(['brand', 'model', 'year'])
>>> dict1.values()
dict_values(['mrcet', 'college', 2004])
>>> dict1.items()
dict_items([('brand', 'mrcet'), ('model', 'college'), ('year', 2004)])
```

>>> for items in dict1.values():
 print(items)

```
mrcet
college
2004
```

```
>>> for items in dict1.keys():  
    print(items)
```

```
brand
model
year
```

```
>>> for i in dict1.items():  
    print(i)
```

```
('brand', 'mrcet')
('model', 'college')
('year', 2004)
```

Some more operations like:

- Add/change

- Remove
- Length
- Delete

Add/change values: You can change the value of a specific item by referring to its key name

```
>>> dict1 = {"brand":"mrcet","model":"college","year":2004}
>>> dict1["year"]=2005
>>> dict1
{'brand': 'mrcet', 'model': 'college', 'year': 2005}
```

Remove(): It removes or pop the specific item of dictionary.

```
>>> dict1 = {"brand":"mrcet","model":"college","year":2004}
>>> print(dict1.pop("model"))
college
>>> dict1
{'brand': 'mrcet', 'year': 2005}
```

Delete: Deletes a particular item.

```
>>> x = {1:1, 2:4, 3:9, 4:16, 5:25}
>>> del x[5]
>>> x
```

Length: we use len() method to get the length of dictionary.

```
>>>{1: 1, 2: 4, 3: 9, 4: 16}
{1: 1, 2: 4, 3: 9, 4: 16}
>>> y=len(x)
>>> y
4
```

Iterating over (key, value) pairs:

```
>>> x = {1:1, 2:4, 3:9, 4:16, 5:25}
>>> for key in x:
    print(key, x[key])
```

```
1 1
2 4
3 9
```

```
4 16
5 25
>>> for k,v in x.items():
    print(k,v)
```

```
1 1
2 4
3 9
4 16
5 25
```

List of Dictionaries:

```
>>> customers = [{"uid":1,"name":"John"},
    {"uid":2,"name":"Smith"},
    {"uid":3,"name":"Andersson"},
    ]
>>> >>> print(customers)
[{'uid': 1, 'name': 'John'}, {'uid': 2, 'name': 'Smith'}, {'uid': 3, 'name': 'Andersson'}]
```

Print the uid and name of each customer

```
>>> for x in customers:
    print(x["uid"], x["name"])
```

```
1 John
2 Smith
3 Andersson
```

Modify an entry, This will change the name of customer 2 from Smith to Charlie

```
>>> customers[2]["name"]="charlie"
>>> print(customers)
[{'uid': 1, 'name': 'John'}, {'uid': 2, 'name': 'Smith'}, {'uid': 3, 'name': 'charlie'}]
```

Add a new field to each entry

```
>>> for x in customers:
    x["password"]="123456" # any initial value
```

```
>>> print(customers)
```

```
[{'uid': 1, 'name': 'John', 'password': '123456'}, {'uid': 2, 'name': 'Smith', 'password': '123456'}, {'uid': 3, 'name': 'charlie', 'password': '123456'}]
```

```
## Delete a field
```

```
>>> del customers[1]
```

```
>>> print(customers)
```

```
[{'uid': 1, 'name': 'John', 'password': '123456'}, {'uid': 3, 'name': 'charlie', 'password': '123456'}]
```

```
>>> del customers[1]
```

```
>>> print(customers)
```

```
[{'uid': 1, 'name': 'John', 'password': '123456'}]
```

```
## Delete all fields
```

```
>>> for x in customers:
```

```
    del x["uid"]
```

```
>>> x
```

```
{'name': 'John', 'password': '123456'}
```

Comprehension:

Dictionary comprehensions can be used to create dictionaries from arbitrary key and value expressions:

```
>>> z={x: x**2 for x in (2,4,6)}
```

```
>>> z
```

```
{2: 4, 4: 16, 6: 36}
```

```
>>> dict11 = {x: x*x for x in range(6)}
```

```
>>> dict11
```

```
{0: 0, 1: 1, 2: 4, 3: 9, 4: 16, 5: 25}
```

