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| **Statement of integrity:** By typing the names of all group members in the text boxes below, you confirm that the assignment submitted is original work produced by the group (excluding any non-contributing members identified with an “X” above). | |
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# Individual answers to Steps1 and 2 -

# Introduction of Data Structures

## Definition -

It’s an organized process to store and retrieve data and helps to write complex programs and it can be accessed more efficiently. There are different types of data structures for different purposes.

## Types of data structures :

Basic types of data structures include - Lists, Sets, Dictionaries, Tuple. Each of them is unique in their own way.

### Lists : These are just like arrays used in other languages. It’s flexible in nature as the items in the lists need not be of the same type. These are used for storing multiple items in a single variable. We use square brackets to store the data separated by comma. These are dynamic, mutable, ordered and lists allow duplicates.

Lists can be declared as -

list\_1 = [1, 2, 3, 4, 5]

We can also use the ‘for’ loop inside a list.

Let’s consider a sample example for list using a for loop

INPUT-

elements = [ele for ele in range(10)]

print(elements)

OUTPUT-

[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]

Will store all the elements of the range 0 to 9

Elements of the lists are accessed by index.

Such as : list\_1[0] will print 1 to the console which is the first element of the list\_1

These are also known as arrays or sequences. Items of any data type can be added or removed from the list. We can also join two lists together by just using + operator as we perform operations on numbers or strings

### Methods used in lists :

### append() : this method will append one element at the end of the list

copy() : returns a copy of lists

sort(): sorts the list alphanumerically

extend(): add elements of the list to the end of the current list

count(): returns the specified number of times a value occurs in the list.

insert(): adds an element at a specified position

reverse(): reverses the order of the list

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### Dictionaries : It contains key-value pair data. It is an ordered collection of data and doesn’t allow duplicates. It is created by placing a sequence of elements within curly {} braces, separated by ‘comma’. Dictionary keys are case sensitive, if they have the same name but different cases of Key will be treated distinctly.

Example -

INPUT :

dict\_1 = {'name': 's', 'class': 'wqufe'}

print(dict\_1)

OUTPUT :

{'name': 's', 'class': 'wqufe'}

### Nested dictionary :

It stores a dictionary inside a dictionary.

E.g code:

dict\_2 = {'name': 'shailza', 'class': {'finance':'wqufe', 'programming': 'ds\_module'}}

print(dict\_2)

OUTPUT

{'name': 'shailza', 'class': {'finance': 'wqufe', 'programming': 'ds\_module'}}

#Here we are printing the dictionary as it is.

print(dict\_2['class'])

# Here we are trying to print the second element of the dictionary that we declared.

OUTPUT

{'finance': 'wqufe', 'programming': 'ds\_module'}

print(dict\_2['class']['finance'])

In this example, we can see how the second nested key value is used to print the element of a dictionary

OUTPUT

wqufe

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### Dictionary Methods:

There is a set of built in methods that we can use in a dictionary-

clear()- This will remove all elements of the dictionary

pop()- Removes element with the specified key

copy()- Returns a copy of a dictioanry

update()- It updates the dictionary with a stated number of key-value pairs.

Similarly there are many more methods that we can use to work with dictionaries.

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### Tuple : It’s used to store multiple items in a single variable. It’s ordered and can not be updated or changed. It allows duplicates of data. It is similar to a list in terms of indexing, nested objects, and repetition but a tuple is immutable while lists are mutable.For tuples we use round brackets.

Example -

INPUT:

tuple\_1 = (3,4,5,6,7)

print(tuple\_1)

OUTPUT:

(3, 4, 5, 6, 7)

If we need to add some items in the tuple then it can not be done directly as we do in lists but we have to first convert it to a list and then we can use the append function to do the same.

Example:

INPUT:

tup\_2 = list(tuple\_1)

print(tup\_2)

OUTPUT:

[3, 4, 5, 6, 7]

INPUT:

tup\_2.append(10)

print(tup\_2)

OUTPUT:

[3, 4, 5, 6, 7, 10]

INPUT:

tuple\_2 = tuple(tup\_2)

print(tuple\_2)

OUTPUT:

(3, 4, 5, 6, 7, 10)

As we can see in this question the tuple is updated by first converting that to list and then to tuple back.

We can also iterate items in the tuple using a for loop

Example:

INPUT:

for x in tuple\_2:

print(x)

OUTPUT:

3

4

5

6

7

10

Tuples can also be joined together using ‘ + ‘

INPUT:

tuple\_2 + tuple\_2

OUTPUT:

(3, 4, 5, 6, 7, 10, 3, 4, 5, 6, 7, 10)

Tuples can also be multiplied n times

INPUT:

tuple\_2 \* 5

OUTPUT:

(3, 4, 5, 6, 7, 10, 3, 4, 5, 6, 7, 10, 3, 4, 5, 6, 7, 10, 3, 4, 5, 6, 7, 10, 3, 4, 5, 6, 7, 10)

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### Tuple methods :

In tuple we have only two built-in methods that we can use -

count() - It counts the number of times a value has occurred.

index() - returns the index or position of the element

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# Applications in the real world:

One of the most elegent application of list and dictionary data structures is when we store data, both structured or unstructured data in ‘JSON’ format. JSON format is nothing but a nested combination of lists and dictionaries. Dictionaries can also be used in encription/decryption of information by utilizing dictionary’s highly accessible key-value structure for bot encoding and decoding, atleast for the simple cases of encription, like substitution : in which we just word replace each character/word with a randomly decided number, word or even a symbol. A very nice example of utilization of List’s flexibility is Deque dataq structure. It basically adds the functionality of append and pop at both ends of a list. The we can easily utilize this deque as both an example of queue or stacks. A queue is basically a list that follows the principle of ‘first in first out’ while stack follows ‘ Last in first out’. So basically, all kinds of undo applications utilize this stacks applications. Therefore, when we press undo out last recorded action gets reverted. An application queue is in the online retail market which would ensure that most recently placed order gets fullfilled first.

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# Advantages and Disadvantages :

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### Dictionaries:

| **Advantages** | **Disadvantages** |
| --- | --- |
| It improves the readability of the code. | These are unordered. |
| To quickly access the value, it links the value to the unique key. | These take more space than other data structures. |

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### Lists:

| **Advantages** | **Disadvantages** |
| --- | --- |
| To store multiple items in a single variable. | These can be appended only at the end. |
| Ordered, Mutable, Dynamic, | It is not a linked list at all. |

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### Tuples:

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| **Advantages** | **Disadvantages** |
| --- | --- |
| These are faster than lists | Cannot add, sort, remove, replace an element in tuple. |
| Make the code safe from accidental modification | These are immutable and so cannot be changed. |

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**Study-aid / crib-sheet for best practices :**

| **List/Tuple :**  **Creating an empty list /tuple:**  Example:  Lists: cribList = []  Tuples: cribTuple = ()  **Update an item of List/tuple:**  Example:  Lists: cribList[x] = "x“  Tuples: tuples are immutable!  **Access an element in position x in list/tuple:**  Example:  "x" in cribListOrTuple  **Remove element in position X of list/tuple**:  Example:  Lists: del cribList[x]  Tuples: tuples are immutable!  **Change a list/tuple to tuple/list:**  Example:  List to Tuple: tuple(cribList)  Tuple to List: list(cribTuple) |
| --- |

| **Dictionaries :**  **Creating an empty Dict**  Example:  cribDict = {}  **Adding an element with key "x" to the Dict**  Example:  cribDict["x"] = value  **Modify the element with key "x"**  Example:  cribDict["x"] = newValue  **Validate if the dictionary has key "x"**  Example:  "x" in cribDict  **Obtain the list of keys**  Example:  cribDict.keys()  **Check the size of the dictionary**  Example:  len(cribDict)  **Remove an element with key "x" from the dictionary**  Example:  del cribDict["k"]  **Remove all the elements in the dictionary**  Example:  cribDict.clear() |
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Reference

<https://www.geeksforgeeks.org/python-data-structures/>