Chapter 10:

Computer Science

Class XI (As per CBSE Board)

New Syllabus 2019-20

List Manipulation

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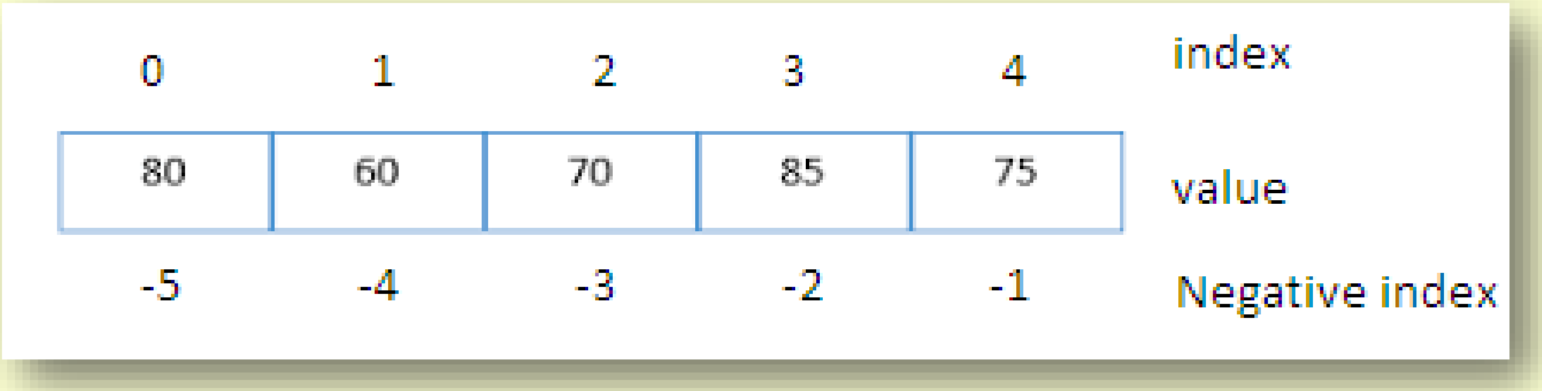
List Manipulation

It is a collections of items and each item has its own index value.
Index of first item is 0 and the last item is n-1.Here n is number of items in a list.

Indexing of list



0	1	2	3	4	index
80	60	70	85	75	value
-5	-4	-3	-2	-1	Negative index

List Manipulation

Creating a list

Lists are enclosed in square brackets [ ] and each item is separated by a comma.

e.g.

```
list1 = [‘English', ‘Hindi', 1997, 2000];
list2 = [11, 22, 33, 44, 55 ];
list3 = ["a", "b", "c", "d"];
```

List Manipulation

Access Items From A List

List items can be accessed using its index position.

e.g.

```
list =[3,5,9]
print(list[0])
print(list[1])
print(list[2])
print('Negative indexing')
print(list[-1])
print(list[-2])
print(list[-3])
```

output

```
3
5
9
Negative indexing
9
5
3
```

List Manipulation

Iterating Through A List

List elements can be accessed using looping statement.

e.g.

```
list =[3,5,9]
for i in range(0, len(list)):
    print(list[i])
```

Output

```
3
5
9
```

List Manipulation

Slicing of A List

List elements can be accessed in subparts.

e.g.

```
list =['I','N','D','I','A']
print(list[0:3])
print(list[3:])
print(list[:])
```

Output

```
['I', 'N', 'D']
['I', 'A']
['I', 'N', 'D', 'I', 'A']
```

List Manipulation

Updating Lists

We can update single or multiple elements of lists by giving the slice on the left-hand side of the assignment operator.

e.g.

```
list = ['English', 'Hindi', 1997, 2000]
print ("Value available at index 2 : ", list[2])
list[2:3] = 2001,2002 #list[2]=2001 for single item update
print ("New value available at index 2 : ", list[2])
print ("New value available at index 3 : ", list[3])
```

Output

```
('Value available at index 2 : ', 1997)
('New value available at index 2 : ', 2001)
('New value available at index 3 : ', 2002)
```

List Manipulation

Add Item to A List

append() method is used to add an Item to a List.

e.g.

```
list=[1,2]
print('list before append', list)
list.append(3)
print('list after append', list)
```

Output

```
('list before append', [1, 2])
('list after append', [1, 2, 3])
```

NOTE :- extend() method can be used to add multiple item at a time in list.eg - list.extend([3,4])

List Manipulation

Add Item to A List

append() method is used to add an Item to a List.

e.g.

```
list=[1,2]
print('list before append', list)
list.append(3)
print('list after append', list)
```

Output

```
('list before append', [1, 2])
('list after append', [1, 2, 3])
```

NOTE :- extend() method can be used to add multiple item at a time in list.eg - list.extend([3,4])

List Manipulation

Add Two Lists

e.g.

```
list = [1,2]
list2 = [3,4]
list3 = list + list2
print(list3)
```

OUTPUT

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

List Manipulation

Delete Item From A List

e.g.

```
list=[1,2,3]
print('list before delete', list)
del list [1]
print('list after delete', list)
```

Output

```
('list before delete', [1, 2, 3])
('list after delete', [1, 3])
```

e.g.

```
del list[0:2] # delete first two items
del list # delete entire list
```

List Manipulation

Basic List Operations

Python Expression	Results	Description
len([4, 2, 3])	3	Length
[4, 2, 3] + [1, 5, 6]	[4, 2, 3, 1, 5, 6]	Concatenation
[‘cs!'] * 4	['cs!', 'cs!', 'cs!', 'cs!']	Repetition
3 in [4, 2, 3]	True	Membership
for x in [4,2,3] : print (x,end = ' ')	4 2 3	Iteration

List Manipulation

Important methods and functions of List

Function	Description
list.append()	Add an Item at end of a list
list.extend()	Add multiple Items at end of a list
list.insert()	insert an Item at a defined index
list.remove()	remove an Item from a list
del list[index]	Delete an Item from a list
list.clear()	empty all the list
list.pop()	Remove an Item at a defined index
list.index()	Return index of first matched item
list.sort()	Sort the items of a list in ascending or descending order
list.reverse()	Reverse the items of a list
len(list)	Return total length of the list.
max(list)	Return item with maximum value in the list.
min(list)	Return item with min value in the list.
list(seq)	Converts a tuple, string, set, dictionary into list.

List Manipulation

Some Programs on List

* find the largest number in a list

#Using sort

```
a=[]
n=int(input("Enter number of elements:"))
for i in range(1,n+1):
    b=int(input("Enter element:"))
    a.append(b)
a.sort()
print("Largest element is:",a[n-1])
```

#using function definition

```
def max_num_in_list( list ):
    max = list[ 0 ]
    for a in list:
        if a > max:
            max = a
    return max
print(max_num_in_list([1, 2, -8, 0]))
```

```
list1, list2 = [123, 'xyz', 'zara', 'abc'], [456, 700, 200]
print "Max value element : ", max(list1)
print "Max value element : ", max(list2)
Output
Max value element :  zara
Max value element :  700
```

List Manipulation

Some Programs on List

* find the mean of a list

```
def Average(lst):
    return sum(lst) / len(lst)

# Driver Code
lst = [15, 9, 55, 41, 35, 20, 62, 49]
average = Average(lst)

# Printing average of the list
print("Average of the list =", round(average, 2))
```

Output

```
Average of the list = 35.75
```

Note : The inbuilt function mean() can be used to calculate the mean(average) of the list.e.g. mean(list)

List Manipulation

Some Programs on List

* Linear Search

```
list_of_elements = [4, 2, 8, 9, 3, 7]

x = int(input("Enter number to search: "))

found = False

for i in range(len(list_of_elements)):
 if(list_of_elements[i] == x):
  found = True
  print("%d found at %dth position"%(x,i))
  break

if(found == False):
 print("%d is not in list"%x)
```

List Manipulation

Some Programs on List

* Frequency of an element in list

```
import collections
my_list = [101,101,101,101,201,201,201,201]
print("Original List : ",my_list)
ctr = collections.Counter(my_list)
print("Frequency of the elements in the List : ",ctr)
```

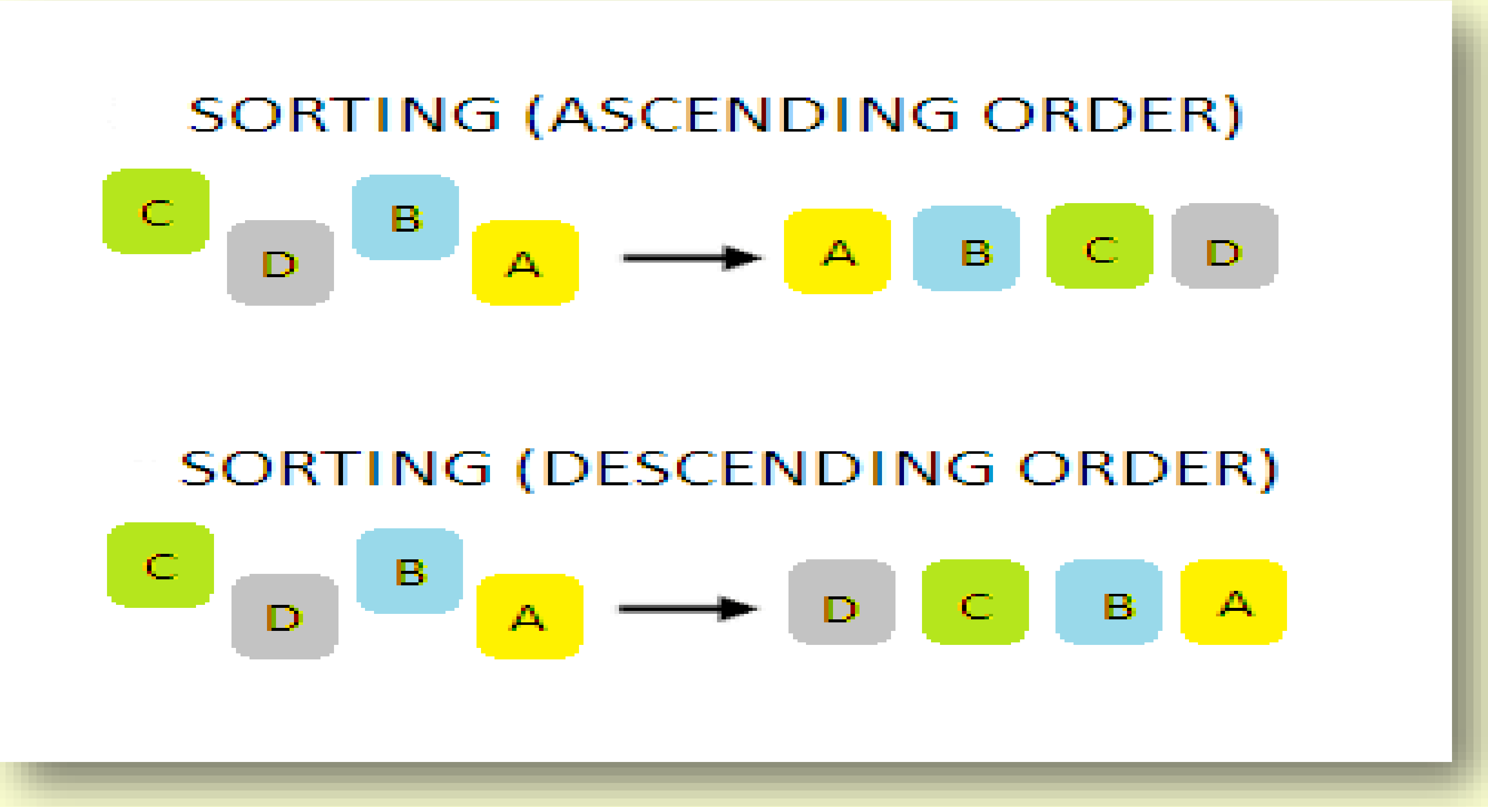
OUTPUT

```
 Original List :  [101, 101,101, 101, 201, 201, 201, 201]
Frequency of the elements in the List :  Counter({101: 4, 201:4})
```

NOTE :SAME CAN BE DONE USING COUNT FUNCTION.E.G. lst.count(x)

SORTING

Sorting is process of arranging items systematically ,according to a comparison operator applied on the elements.



SORTING

There are various softing algorithms .Two of them are-

1. **Bubble Sort**

2. **Insertion Sort**

SORTING

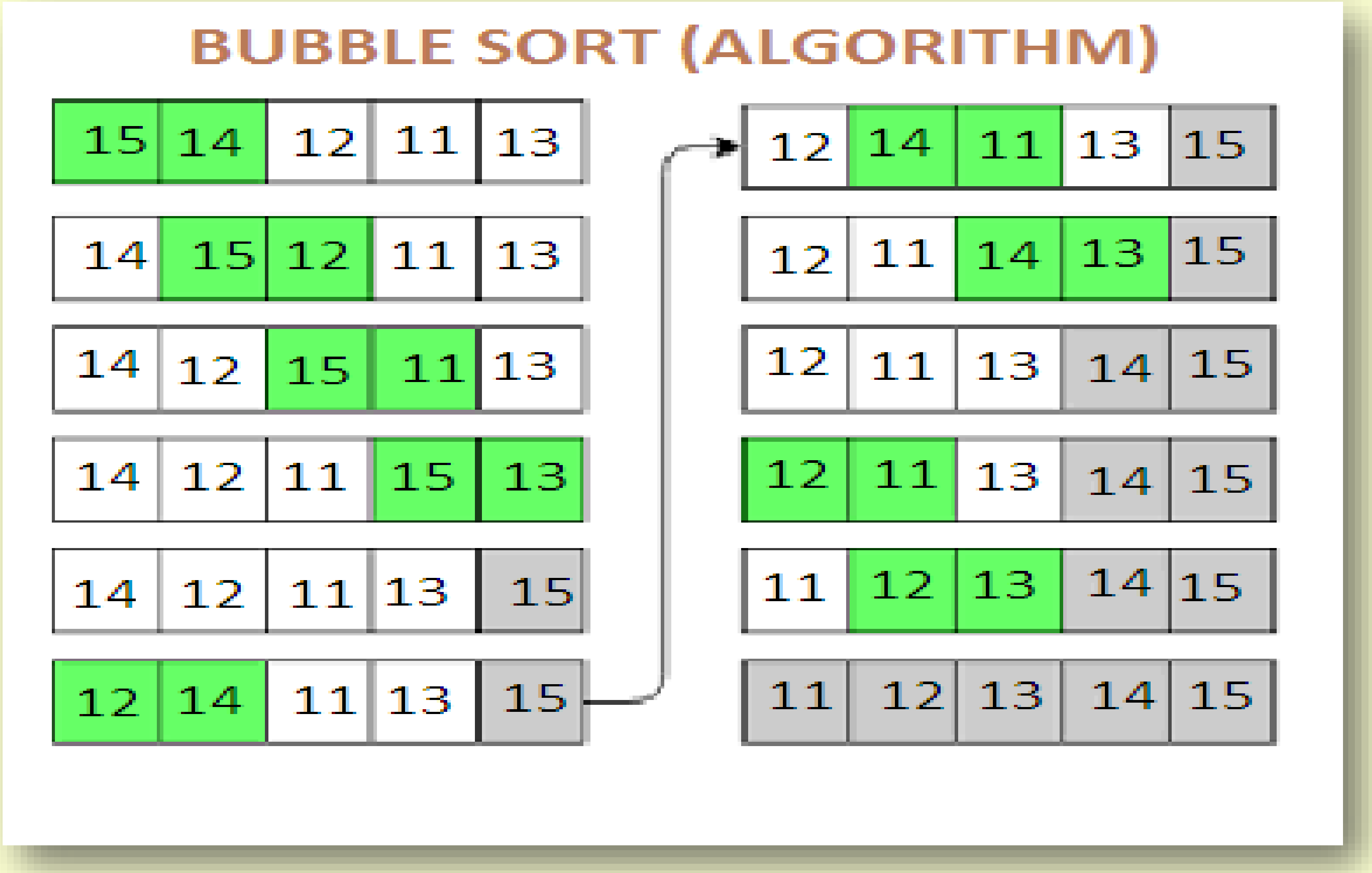
1. Bubble Sort-

It is one of the simplest sorting algorithms. The two adjacent elements of a list are checked and swapped if they are in wrong order and this process is repeated until the whole list elements are sorted. The steps of performing a bubble sort are:

1. Compare the first and the second element of the list and swap them if they are in wrong order.
2. Compare the second and the third element of the list and swap them if they are in wrong order.
3. Proceed till the last element of the list in a similar fashion.
4. Repeat all of the above steps until the list is sorted.

SORTING

1. Bubble Sort-



BUBBLE SORT (ALGORITHM)

15	14	12	11	13
14	15	12	11	13
14	12	15	11	13
14	12	11	15	13
14	12	11	13	15
12	14	11	13	15

12	14	11	13	15
12	11	14	13	15
12	11	13	14	15
12	11	13	14	15
11	12	13	14	15
11	12	13	14	15

SORTING

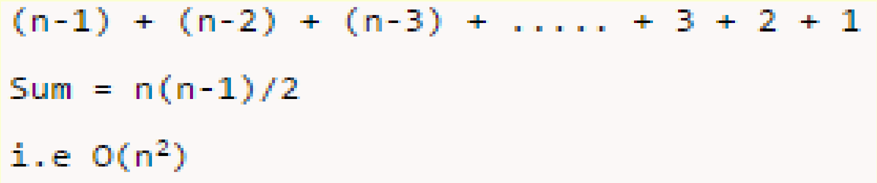
1. Bubble Sort-Python Program

```
a = [6, 19, 1, 15, 11, 12, 14]
#repeating loop len(a)(number of elements) number of times
for j in range(len(a)):
    #initially swapped is false
    swapped = False
    i = 0
    while i<len(a)-1:
        #comparing the adjacent elements
        if a[i]>a[i+1]:
            #swapping
            a[i],a[i+1] = a[i+1],a[i]
            #Changing the value of swapped
            swapped = True
        i = i+1
    #if swapped is false then the list is sorted
    #we can stop the loop
    if swapped == False:
        break
print (a)
```

SORTING

1. Bubble Sort- No of Operation in sorting

In Bubble Sort, n-1 comparisons will be done in the 1st pass, n-2 in 2nd pass, n-3 in 3rd pass and so on. So the total number of comparisons will be as follows-



```
(n-1) + (n-2) + (n-3) + ..... + 3 + 2 + 1

Sum = n(n-1)/2

i.e O(n²)
```

Hence time complexity of Bubble Sort is O(n2).

The main advantage of Bubble Sort is the simplicity of the algorithm.

The space complexity for Bubble Sort is O(1), because only a single additional memory space is required .

Also, the best case time complexity will be O(n),only when the list is already sorted.

Following are the Time and Space complexity for the Bubble Sort algorithm.

Worst Case Time Complexity [Big-O]: O(n2)

Best Case Time Complexity [Big-omega]: O(n)

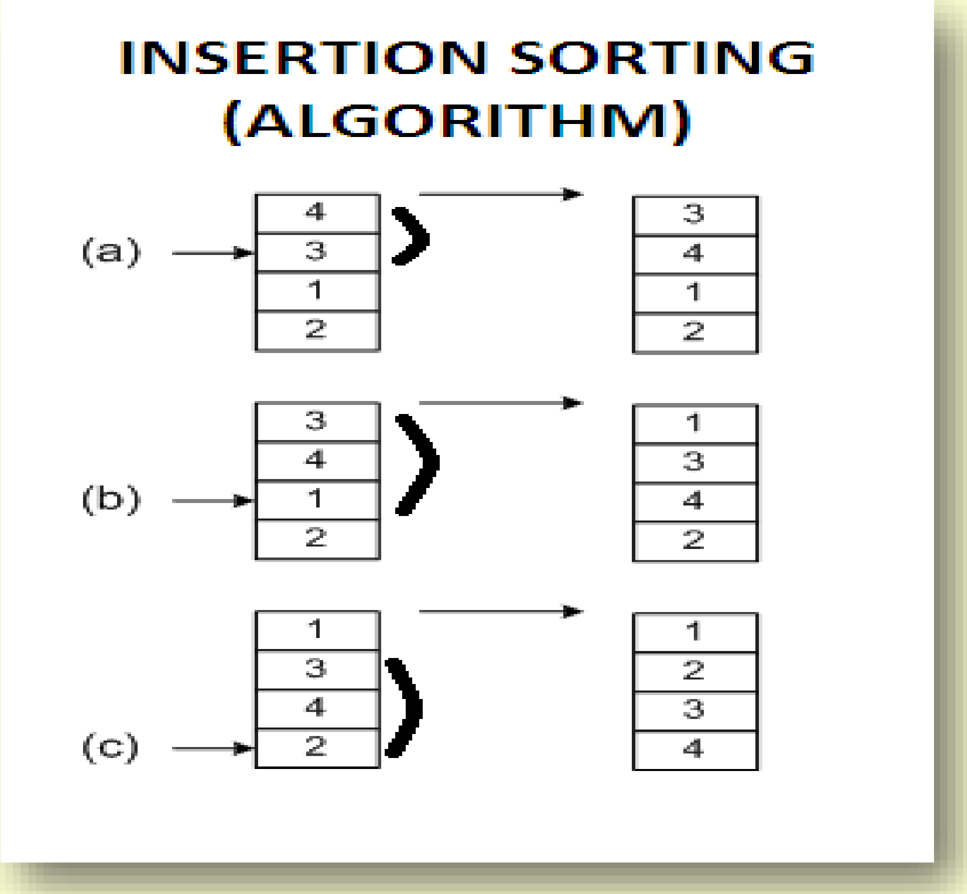
Average Time Complexity [Big-theta]: O(n2)

Space Complexity: O(1)

SORTING

2. Insertion Sort –

Insertion sort is a simple sorting algorithm .It is just similar the way we sort playing cards in our hands.



SORTING

2. Insertion Sort – Python Program

```
list = [19, 12, 13, 15, 6]
for i in range(1, len(list)):
         key = list[i]
         # Move elements of list[0..i-1], that are
        # greater than key, to one position next
        # of their current position
        j = i-1
        while j >=0 and key < list[j] :
                list[j+1] = list[j]
                j -= 1
        list[j+1] = key
print ("Sorted listay is:")
for i in range(len(list)):
    print ("%d" %list[i])
```

SORTING

2. Insertion Sort – No of Operation in sorting

In insertion sort ,to insert the last element at most n-1 comparisons and n-1 movements needed.

To insert the n-1st element n-2 comparisons and n-2 movements needed.

….

To insert the 2nd element 1 comparison and one movement needed.

Its sum up is given below:

$2* (1 + 2 + 3 +\ldots N - 1) = 2 * (N - 1)* N / 2 = (N-1)*N = \Theta (N^2)$

If the greater part of the array is sorted, the complexity is almost O(N)

The average complexity is proved to be $= \Theta (N^2)$