NED University of Engineering & Technology

Department of Electrical Engineering

LAB MANUAL

<u>Data Structures and Algorithms</u>

<u>(EE-264)</u>

For

<u>SE Electrical</u>

Instructor name:____

Student name:____

Roll no:______________________ Batch:____________________

Semester:_______________________ Year:__________________

LAB MANUAL

Data Structures and Algorithms (EE-264)

For

SE Electrical

Content Revision Team: **Dr. Riaz Uddin** and **Dr. Mirza Muhammad Ali Baig**

Last Revision Date:

Approved By

The Board of Studies of Department of Electrical Engineering

CONTENTS

<table>
<tr><td colspan="5">CLO (Psychomotor, Level 3): Students should build various basic algorithms, analyze empirically their growth of computational tim;e and formulate object-oriented programming to develop basic data-structures

CLO (Affective, Level 2): Students should build various basic algorithms, analyze empirically their growth of computational time and formulate object-oriented programming to develop basic data-structures</td></tr>
<tr><th>S. No.</th><th>Date</th><th>Title of Experiment</th><th>Total Marks</th><th>Signature</th></tr>
<tr><td>1</td><td></td><td>Introduction to programming with Python</td><td></td><td></td></tr>
<tr><td>2</td><td></td><td>Developing and executing algorithms using Python</td><td></td><td></td></tr>
<tr><td>3</td><td></td><td>To analyze the efficiency of sorting algorithms</td><td></td><td></td></tr>
<tr><td>4</td><td></td><td>To develop and apply the recursive divide and conquer approach in sorting</td><td></td><td></td></tr>
<tr><td>5</td><td></td><td>Extending the divide-and-conquer approach on sorting and searching problems</td><td></td><td></td></tr>
<tr><td>6</td><td></td><td>Apply Asymptotic Notations to the Sorting Algorithms.</td><td></td><td></td></tr>
<tr><td>7</td><td></td><td>Introduction to object oriented programming.</td><td></td><td></td></tr>
<tr><td>8</td><td></td><td>Develop a system which can perform basic banking related tasks</td><td></td><td></td></tr>
<tr><td>9</td><td></td><td>To implement fundamental data structures in Python (using list)
a) Stack
b) Queue</td><td></td><td></td></tr>
<tr><td>10</td><td></td><td>Accomplish the following open-ended tasks:
Using Node class, develop
1. Stacks
2. Queue</td><td></td><td></td></tr>
<tr><td>11</td><td></td><td>Accomplish the open-ended task:
Using Node class, develop Singly connected linked-list</td><td></td><td></td></tr>
</table>

Laboratory Session No. 01

Objective:

To get introduced with fundamentals of programming with Python

Outcomes:

By the end of this lab, student should be able to

a) Correctly code algorithms in python which may include
   1) Loops
   2) Conditions
   3) Lists
   4) User defined functions
   5) Importing libraries to program

1) Loops:

In ***Python**, for* and *while* loops follows the following syntax.

WHILE LOOP:-

```
In [10]: a,b=0,1
         while b<1000:
                 print (b)
                 a,b=b,a+b

1
1
2
3
5
8
13
21
34
55
89
144
233
377
610
987
```

while loop in Python

FOR LOOP:-

```
In [1]: for i in range(0,10):
            print(i)
            print('Marwa Ashfaq\n')

        0
        Marwa Ashfaq

        1
        Marwa Ashfaq

        2
        Marwa Ashfaq

        3
        Marwa Ashfaq

        4
        Marwa Ashfaq

        5
        Marwa Ashfaq

        6
        Marwa Ashfaq

        7
        Marwa Ashfaq

        8
        Marwa Ashfaq

        9
        Marwa Ashfaq
```

for loop in Python

2) **Conditions**:

```
In [2]: a=int(input('please enter a value:'))

        please enter a value:100

In [3]: if a<12:
            print('value is less than 12')
        else:
            print('value is greater than 12')

        value is greater than 12
```

if-else condition in Python

3) **Lists**:

A list is created by placing all items in “square brackets []”.
Elements can be added/appended in a list as well.

```
In [1]: #Defining a list
        list=[0,1,2,3]

In [2]: list

Out[2]: [0, 1, 2, 3]

In [3]: #Adding elements in a list
        list=list + [4]

In [4]: list

Out[4]: [0, 1, 2, 3, 4]

In [12]: #Appending a list
         list.append(5)

In [11]: list

Out[11]: [0, 1, 2, 3, 4, 5]
```

list example

4) User defined Functions:

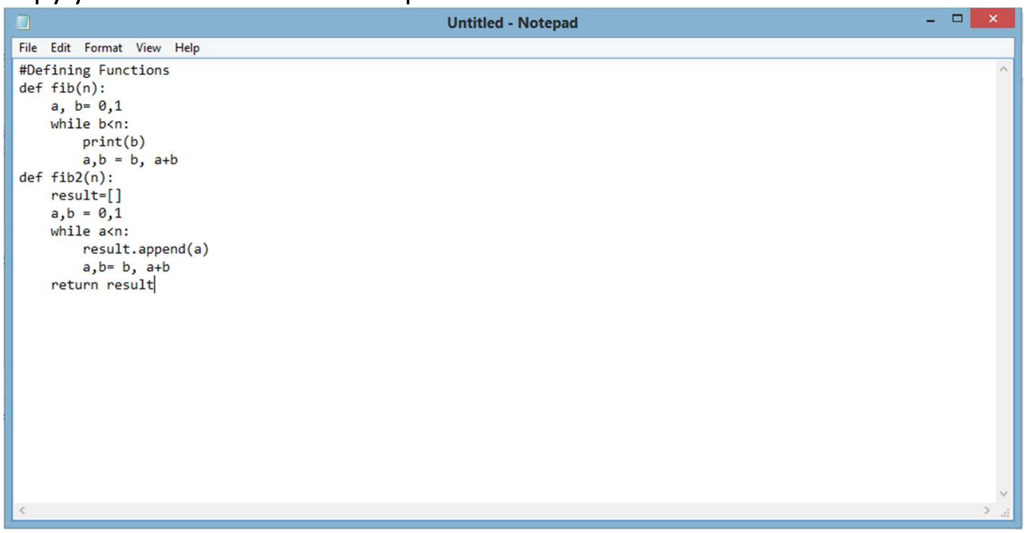
Functions in *Python* can be created by using the syntax shown below. A function is a block of code which only runs when it is called. Defining and calling a function are explained as follows:

```
In [1]: #Defining Functions
        def fib(n):
            a, b= 0,1
            while b<n:
                print(b)
                a,b = b, a+b

In [2]: def fib2(n):
            result=[]
            a,b = 0,1
            while a<n:
                result.append(a)
                a,b= b, a+b
            return result

In [3]: fib(100)

        1
        1
        2
        3
        5
        8
        13
        21
        34
        55
        89

In [4]: fib2(100)

Out[4]: [0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89]
```

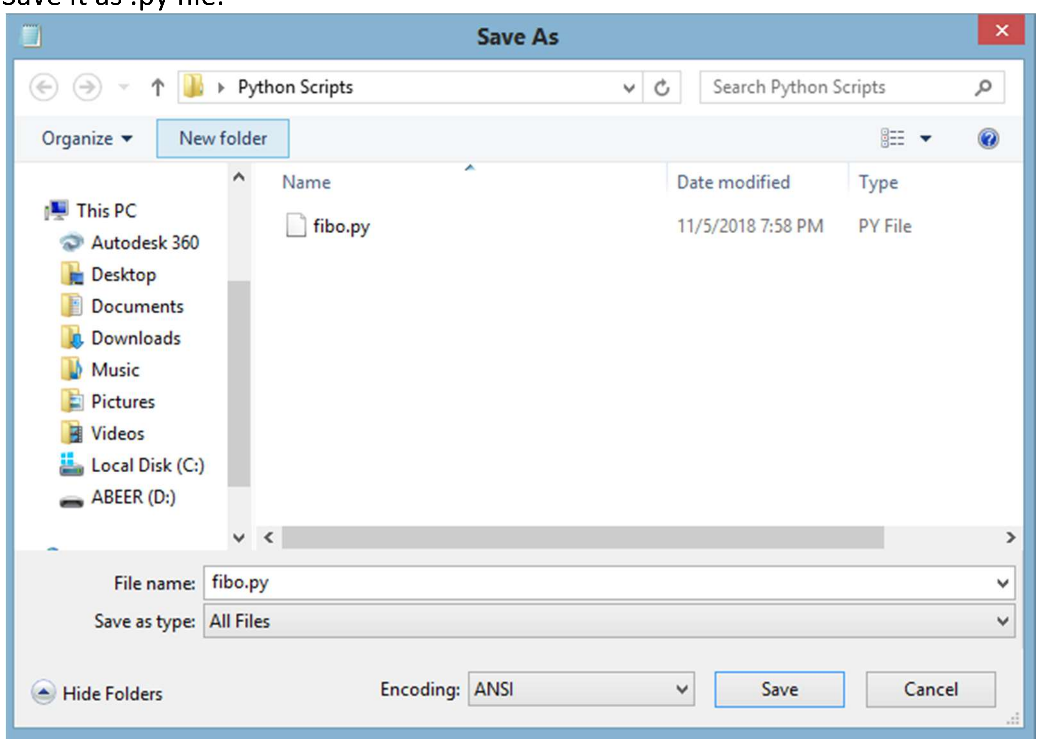
Working with functions in Python

Saving and Importing user-defined function to a program:

- Copy your desired code in notepad.



- Save it as .py file.



- Change its extension from.txt to .py.
- Import as follows:

```
In [2]: import fibo

In [3]: fibo.fib(100)
        1
        1
        2
        3
        5
        8
        13
        21
        34
        55
        89

In [4]: from fibo import fib2

In [5]: fib2(100)
Out[5]: [0, 1, 1, 2, 3, 5, 8, 13,
```

```
In [6]: from fibo import fib

In [7]: fib(100)
        1
        1
        2
        3
        5
        8
        13
        21
        34
        55
        89

In [8]: f=fib2(1000)

In [9]: f
Out[9]: [0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987]
```

Calling user-defined function in Python

5) Importing libraries to program:

Python library is a collection of functions and methods that allows you to perform lots of actions without writing your own code. For importing libraries, the "import" command is used.

Once the library is imported, its different functions can be called. Following is an example which makes use of a library

```
In [1]: import math

In [2]: math.sqrt(121)
Out[2]: 11.0

In [4]: math.factorial(6)
Out[4]: 720

In [5]: math.acos(1)
Out[5]: 0.0

In [6]: math.asin(1)
Out[6]: 1.5707963267948966

In [8]: math.pi
Out[8]: 3.141592653589793
```

Making use of libraries in Python

Laboratory Session No. 02

Objective:

To developing and execute basic algorithms using Python

Outcomes:

By the end of this lab, student should be able to implement following exercises in *Python*

1) Write a program which could generate the following pattern. [hint: use ‘end’ option in pri nt command]

```
*
* *
* * *
* * * *
* * * * *
* * * * * *
* * * * * * *
* * * * * * * *
* * * * * * * * *
* * * * * * * * * *
* * * * * * * * *
* * * * * * * *
* * * * * * *
* * * * * *
* * * * *
* * * *
* * *
* *
*
```

2) Write a program which can generate the following

Input a number: 10
10 x 1 = 10
10 x 2 = 20
10 x 3 = 30
10 x 4 = 40
10 x 5 = 50
10 x 6 = 60
10 x 7 = 70
10 x 8 = 80
10 x 9 = 90
10 x 10 = 100

3) Write a program to prompt for a score between 0.0 and 1.0. If the score is out of range, print an error message. If the score is between 0.0 and 1.0, print a grade using the following table:

>= 0.9 A
>= 0.8 B
>= 0.7 C
>= 0.6 D
< 0.6 F

Enter score: 0.95
A

Enter score: perfect
Bad score

Enter score: 10.0
Bad score
Enter score: 0.75
C

Enter score: 0.5
F

4) Re-write the above program using functions

5) Write a Python function to calculate the factorial of a number. [use recursive approach]

6) Write a function which can search for an entry in a list. Also show the entry count in the list.

7) Develop code in python for sorting a list using selection sort approach. In selection sort you find the minimum value first and place it at the end of the list.

Laboratory Session No. 03

Objective:

To analyze and evaluate experimentally the running time of

1) ***Selection Sort***
2) ***Bubble Sort***
3) ***Insertion Sort***

Special Instructions

1) **You are supposed to translate pseudocodes of the above mentioned codes in *Python*.**
2) **Show in tabulated form, the analytical expressions of computational times for the above algorithms based on RAM model**
3) **Now, evaluate the run time using *time* library functions**
4) **You would need to discuss the average run time of each algorithm for best and worst cases**

1. Selection Sort:

```
for i = 1 to A.length
        min_pos = i
        for j = i+1 to length_of_list
                if list[min_pos] > list[j]
                min_pos = j
        temp = list[i]
        list[i] = list[min_pos]
        list[min_pos] = temp
```

Pseudocode of Selection Sort

```python
def Selection_Sort(M):
    for i in range(0,len(M)):
        min_pos=i
        for j in range (i+1,len(M)):
            if M[min_pos]> M[j]:
                min_pos=j
        temp=M[i]
        M[i]=M[min_pos]
        M[min_pos]=temp
    return(M)
Z=[10,12,6,89,43]
Selection_Sort(Z)
[6,10,12,43,89]
```

```
Out[2]:
      [6, 10, 12, 43, 89]
```

Python Code

Analysis of Selection Sort

	Pseudocode	Cost	Time (Worst)	Time (Best)
1	for i=1 to length_of_list	C_1	n+1	n+1
2	min_pos=i	C_2	n	n
3	for j=i+1 to length_of_list	C_3	$\sum_{j=1}^{n} j=\frac{n(n+1)}{2}$	$\sum_{j=1}^{n} j=\frac{n(n+1)}{2}$
4	if list[min_pos] > list[j]	C_4	$\sum_{j=1}^{n}(j-1)=\frac{n(n-1)}{2}$	$\sum_{j=1}^{n}(j-1)=\frac{n(n-1)}{2}$
5	min_pos = j	C_5	$\sum_{j=1}^{n}(j-1)=\frac{n(n-1)}{2}$	0
6	else	0	n	n
7	temp = list[i]	C_7	n	n
8	list[i] = list[min_pos]	C_8	n	n
9	list[min_pos] = temp	C_9	n	n

Analysis of Selection Sort

Run time of Selection Sort

```
def Selection_Sort(M):
    for i in range(0,len(M)):
        min_pos=i
        for j in range (i+1,len(M)):
            if M[min_pos]> M[j]:
                 min_pos=j
        temp=M[i]
        M[i]=M[min_pos]
        M[min_pos]=temp
    return(M)
Z=[10,12,6,89,43]
```

```
Selection_Sort(Z)
```

```
[6, 10, 12, 43, 89]
```

```
import time
a=time.time()
Selection_Sort(list(range(6000,1,-1)))
b=time.time()
c=b-a
print('run time=',c)
```

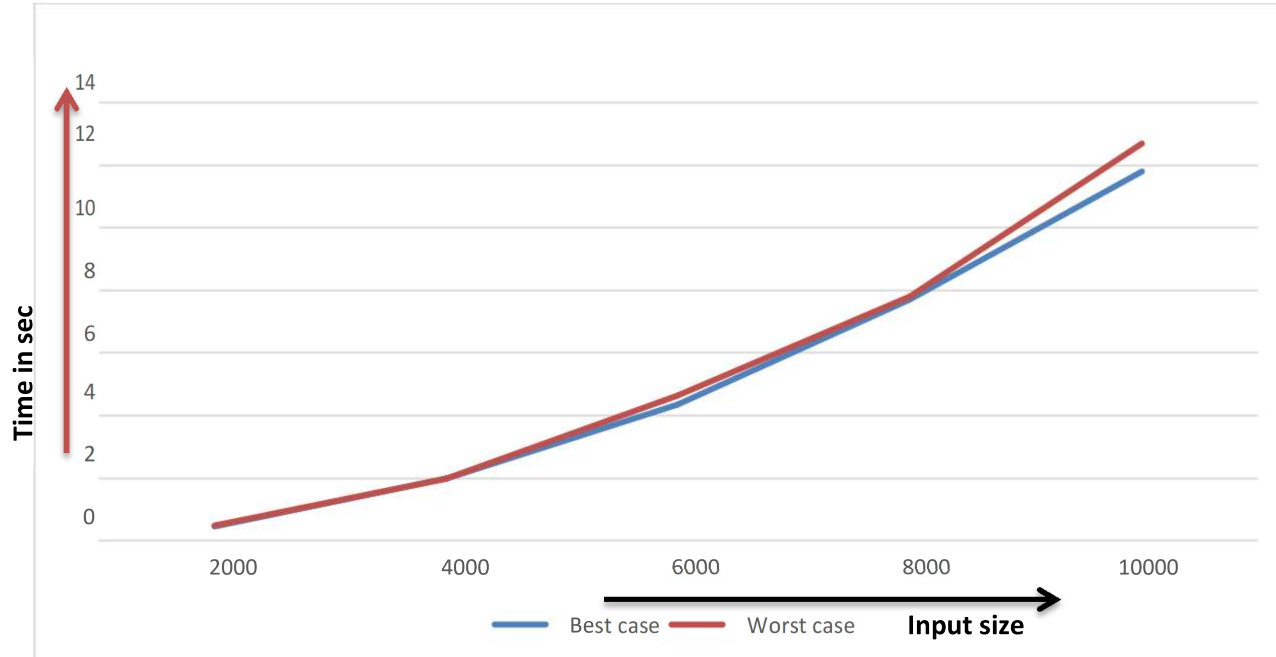
Python implementation for runtime assessment for a worst case

Tabulated run-time of Selection Sort:

After experimenting with the python code for five different sizes of inputs, following run-times were recorded.

S. No	Number of elements in array	Time of Best case(sec)	Time of worst case(sec)
1	2000	0.4653	0.4973
2	4000	1.9898	1.9856
3	6000	4.3554	4.6329
4	8000	7.7099	7.7937
5	10000	11.792	12.696

Growth Plot:



Note:

Student is supposed to repeat similar exercise, for *bubble* and *insertion sort* algorithms.

**keep in mind that your reading will depend on your computer's speed. The above tables and graphs are just for the verification of concepts*

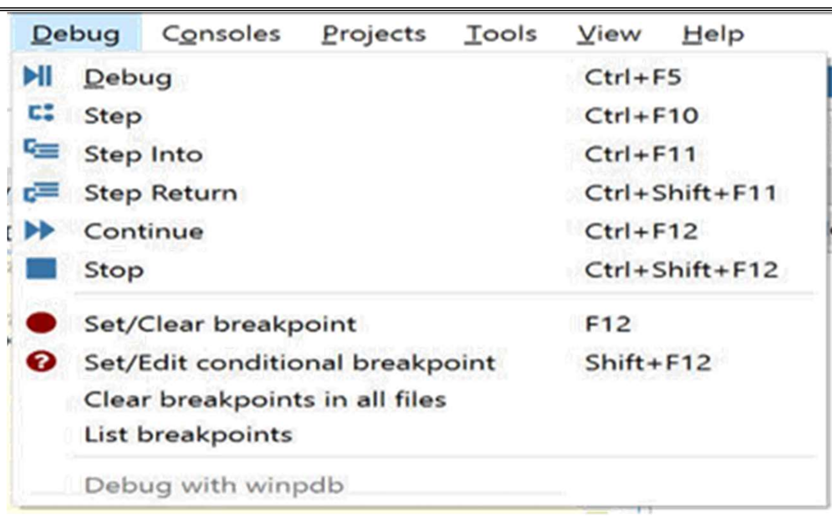
Laboratory Session No. 04

Objective:

To develop and apply the recursive divide and conquer approach in sorting (using debugging tools in Python)

Debugging:

Debugging is a process which involves identifying a problem, isolating the source of the problem and then either correcting the problem or determining a way to look around it. In debugging process, we run the program step-by-step and keep a look on the variables. To invoke the option for debugging in *spyder IDE* we take following steps:



Debugging tools in Spyder

Here, the *DEBUG* option, starts debugging. The *STEP* option, steps to next line of the code. The *STEP INTO* option, takes you inside the function's body. The *STEP RETURN* option, steps to return the function call. The *CONTINUE* option, continues with debugging mode. The *STOP* option, forces the current debugging to stop.

Merge-sort Algorithm:

Merge Sort is based on the approach of *Divide and Conquer*. It divides input array in two halves, calls itself for the two halves and then merges the two sorted halves. The merge() function is used for merging two halves.

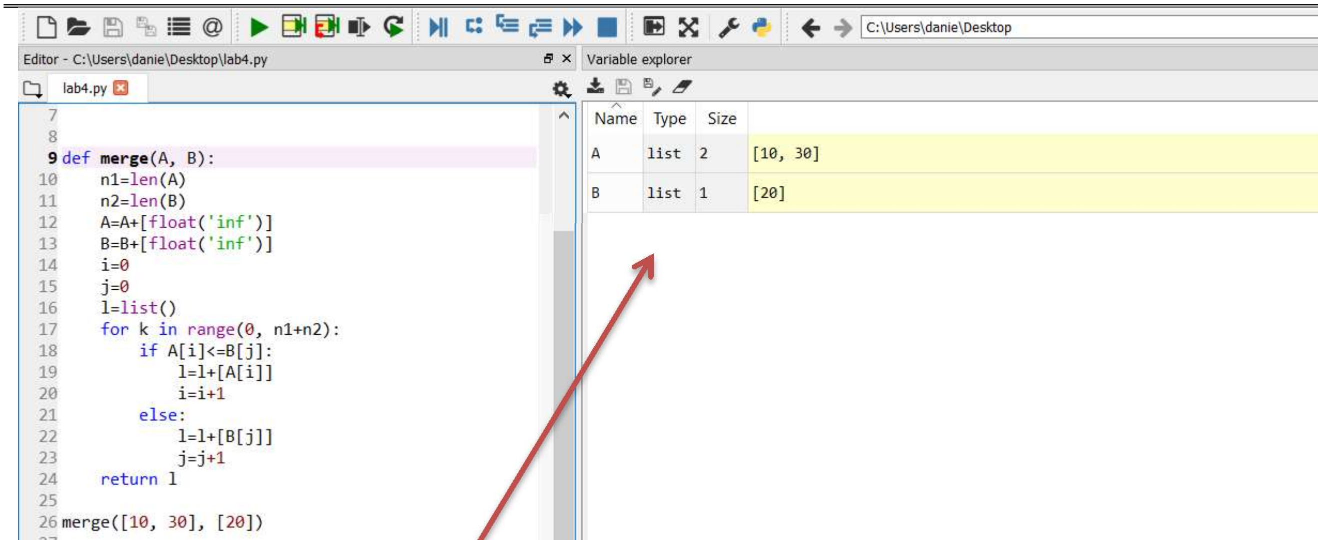
Following is the python-code for mergesort algorithm :

```
def MergeSort(A):
        n=len(A)
        s=list( )
        if n==1:
                s=A
        else:
                a=(n//2)
                s1=MergeSort(A[0:a])
                s2=MergeSort(A[a:n])
                s=merge(s1,s2)

def merge(A,B):
  n1=len(A)
  n2=len(B)
  A=A+[float('inf')]
  B=B+[float('inf')]
  i=0
  j=0
  l=list( )
  for k in range(0,n1+n2):
    if A[i]<=B[j]:
      l=l+[A[i]]
      i=i+1
    else:
      l=l+[B[j]]
      j=j+1
        return l
```

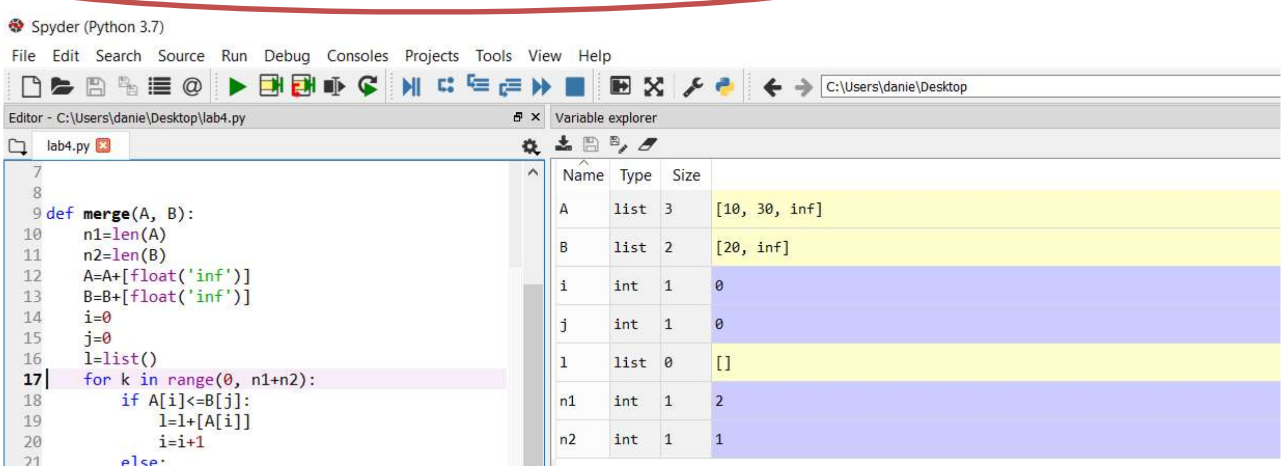
Megesort in Python

In the following section, we see how variables can be watched while running program in debugging mode.

In the following exercise, we see how we can merge two arrays of two and one elements through debugging mode.

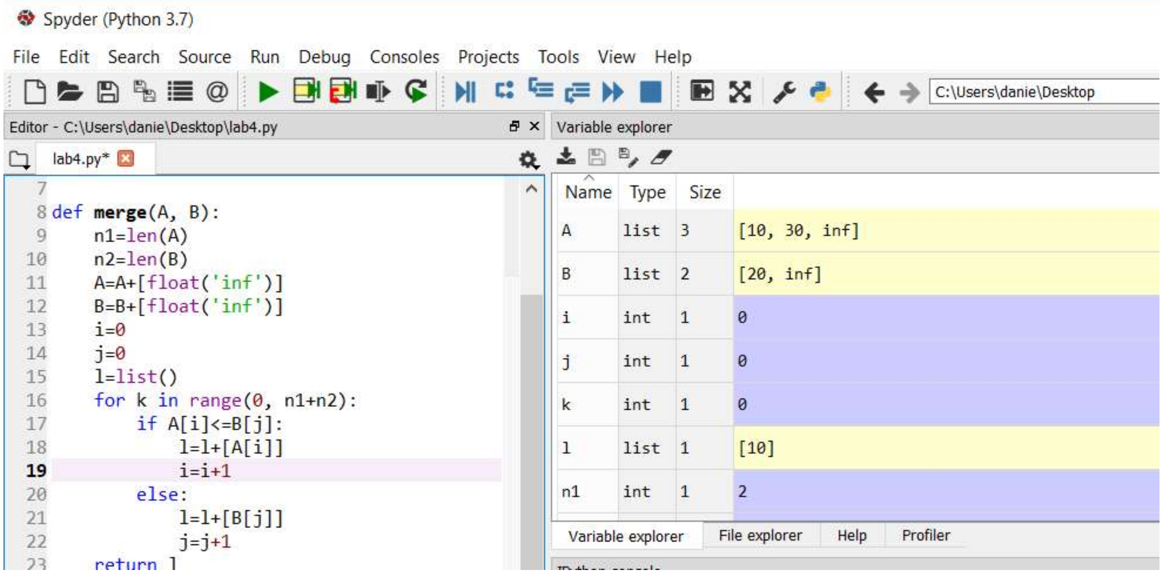


Variables are shown here, before the start of the loop execution

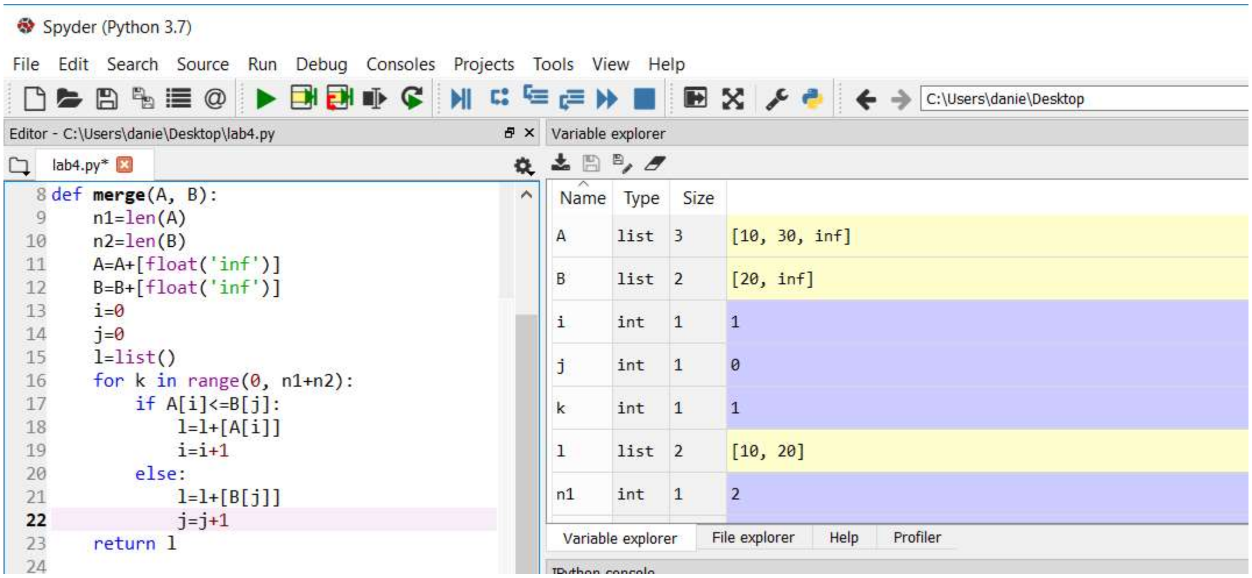


Running merge procedure in debugging mode

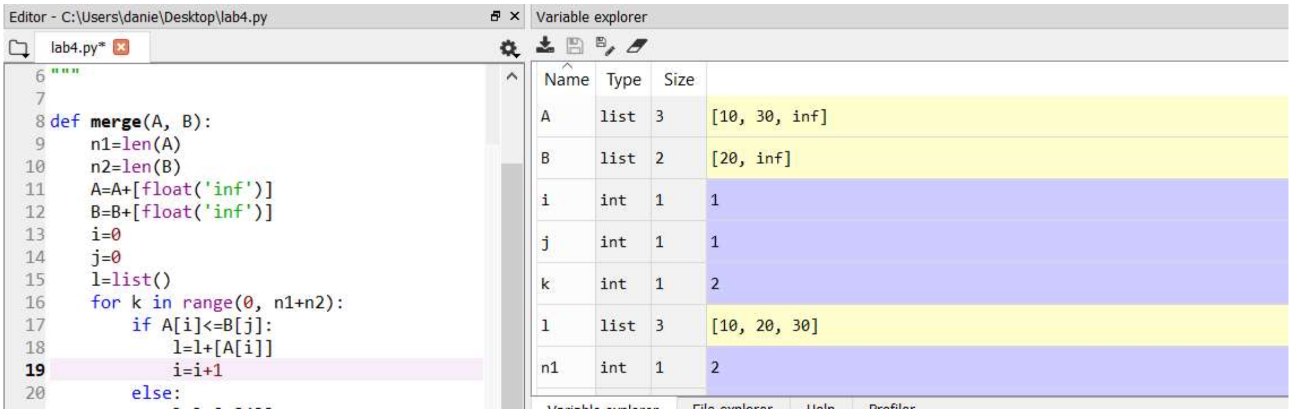
1st iteration of k:



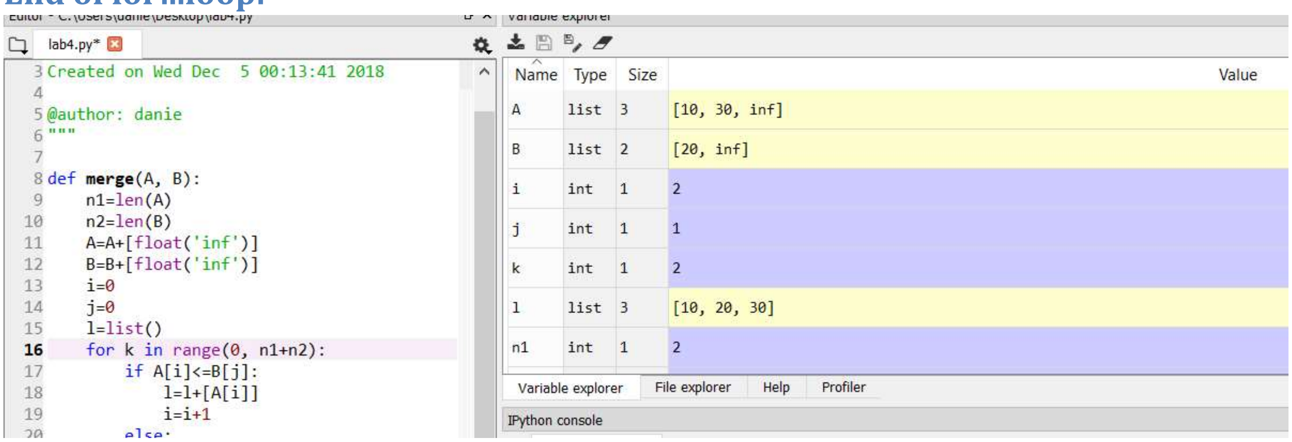
2nd iteration of k:



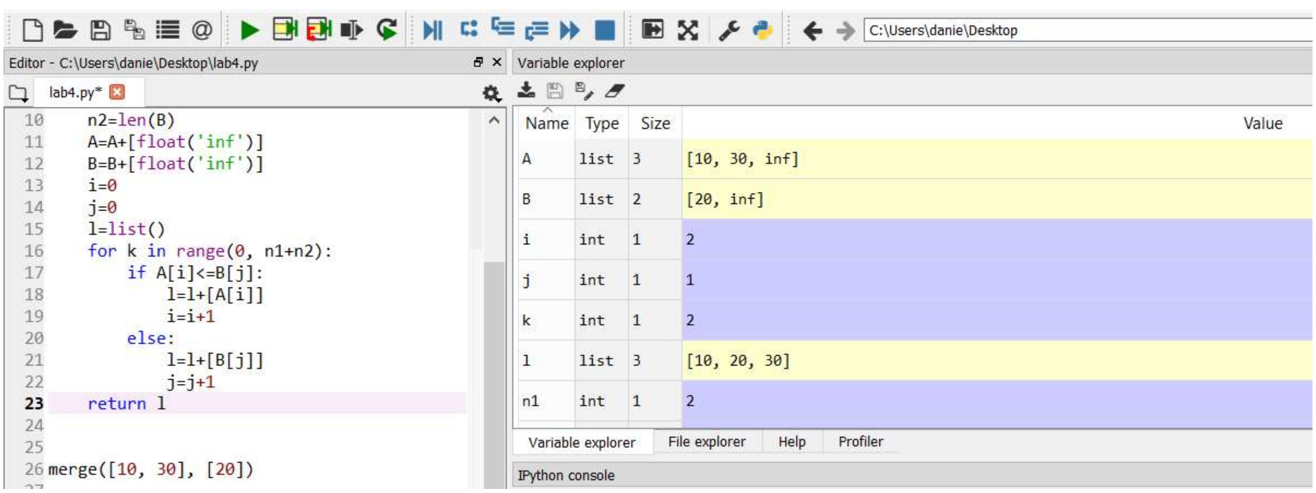
3rd iteration of k:



End of for…loop:



Sorted List returned:



Task:

There are going to be recursive calls in the *mergesort* procedure given above. Student is supposed to note the values of different variables during each recursive call and record their observations.

Further, student is supposed to compare the run-time of *mergesort* algorithm, with the sorting algorithms covered in lab session 03.

Laboratory Session No. 05

Objective:

Extending the divide-and-conquer approach on sorting and searching problems

We first start with the analysis and experimental verification of the run-time of linear search algorithm. The linear search algorithm looks for an entry present in the array sequentially. In the second stage, we apply divide and conquer based approach for searching problem and compare the running time of both linear search and binary search analytically as well as empirically.

The linear search Algorithm

```
def linearsearch(x, key):
   count=0
   flag=0
   for i in range(len(x)):
      count=count+1
      if x[i]==key:
         flag=1
   return flag
```

Code of linear search algorithm in Python

Analysis of Linear Search (perform for best and worst cases)

Pseudocode	frequency	Time
def linearsearch(x, y):		
count=0		
flag=0		
for i in range(len(x)):		
count=count+1		
if x[i]==y:		
flag=1		
return flag		

Code of linear search algorithm in Python

Best case

Worst case

Binary Search

Binary search is done on already sorted array. Program compares the value to be searched from the value present at the mid in the list. If value is lesser than value at mid in the list it looks for the value in the same way in the list on the left of mid. If value is larger than value at mid, it looks in the list on the right of mid. When the value is found it generates an output flag that value is found.

```
def bsearch(A, key):
    f_index=0
    l_index=len(A)-1
    flag=0
    while f_index<=l_index and flag==0:
        mid=(f_index+l_index)//2
        if A[mid]==key:
            flag=1
        elif key<A[mid]:
            l_index=mid-1
        else:
            f_index=mid+1
    return flag
```

Code of binary search algorithm in Python

Analysis of Binary Search

	Pseudocode	Frequency	Time
1	def bsearch(A, key):		
2	f_index=0		
3	l_index=len(A)-1		
4	flag=0		
5	while f_index<=l_index and flag==0:		
6	mid=(f_index+l_index)//2		
7	if A[mid]==key:		
8	flag=1		
9	elif key<A[mid]:		
10	l_index=mid-1		
11	else:		
12	f_index=mid+1		
13	return flag		

Best case

Worst case

Compare the running times of linear search and binary search

<u>Task:</u>

Student is supposed to implement both searching algorithms and test them for different sizes of inputs. To summaries the observations, growth plots should be made.

Laboratory Session No. 06

Objective:

Apply Asymptotic Notations to the Sorting Algorithms.

Θ Notation:

The theta notation bounds a function from above and below, so it defines exact asymptotic behavior.
A simple way to get theta notation of an expression is to drop low order terms and ignore leading constants.

For a given function g(n), we denote Θ(g(n)) is following set of functions.

```
Θ(g(n)) = {f(n): there exist positive constants c1, c2 and n0 such
              that 0 <= c1*g(n) <= f(n) <= c2*g(n) for all n >= n0}
```

The above definition means, if f(n) is theta of g(n), then the value f(n) is always between c1*g(n) and c2*g(n) for large values of n (n >= n0). The definition of theta also requires that f(n) must be non-negative for values of n greater than n0.

Θ Notation for Insertion Sort:

In order to apply theta notation for insertion sort we have to bound the time T(n) graph of insertion sort between two graphs of the same nature that of T(n) but with different constant terms C_1 and C_2 . The analysis is given by:

S.no	n	T(n)	$T(n)/n^2$	C_1n^2	C_2n^2
1	1000	0.06	**C_1=0.000000056**	0.056	0.064
2	5000	1.57	0.00000006	1.5	1.625
3	10000	6.37	0.00000006	6	6.5
4	15000	14.32	0.00000006	13.5	14.62
5	20000	25.5	**C_2=0.000000976**	24.4	26.5

Tabulation of Upper and lower bound asymptotes

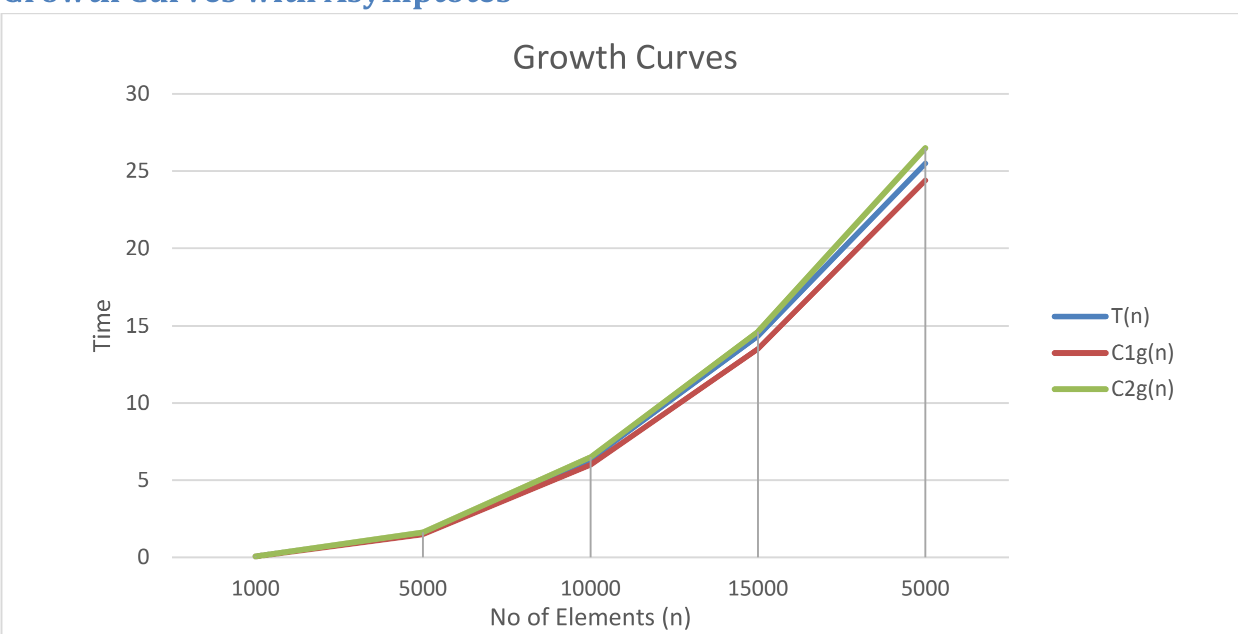
Here n = no of elements

T(n) = Time Complexity

C_1n^2 = Lower Bound

C_2n^2 = Upper Bound

Growth Curves with Asymptotes



Θ Notation for Merge Sort:

In order to apply theta notation for merge sort we have to bound the time T(n) graph of merge sort between two graphs of the same nature that of T(n) but with different constant terms C_1 and C_2 . The analysis is given by:

n	T(n)	T(n)/nlogn	C_1(nLogn)	C_2(nlogn)
1000	0.008	C_1=7.80E-07	0.007773	0.008272
5000	0.05	7.90E-07	0.048536	0.051608
10000	0.1152	C_2=8.22E-07	0.109225	0.118261
15000	0.1761	8.10E-07	0.168553	0.181038
20000	0.2477	8.20E-07	0.234318	0.25375

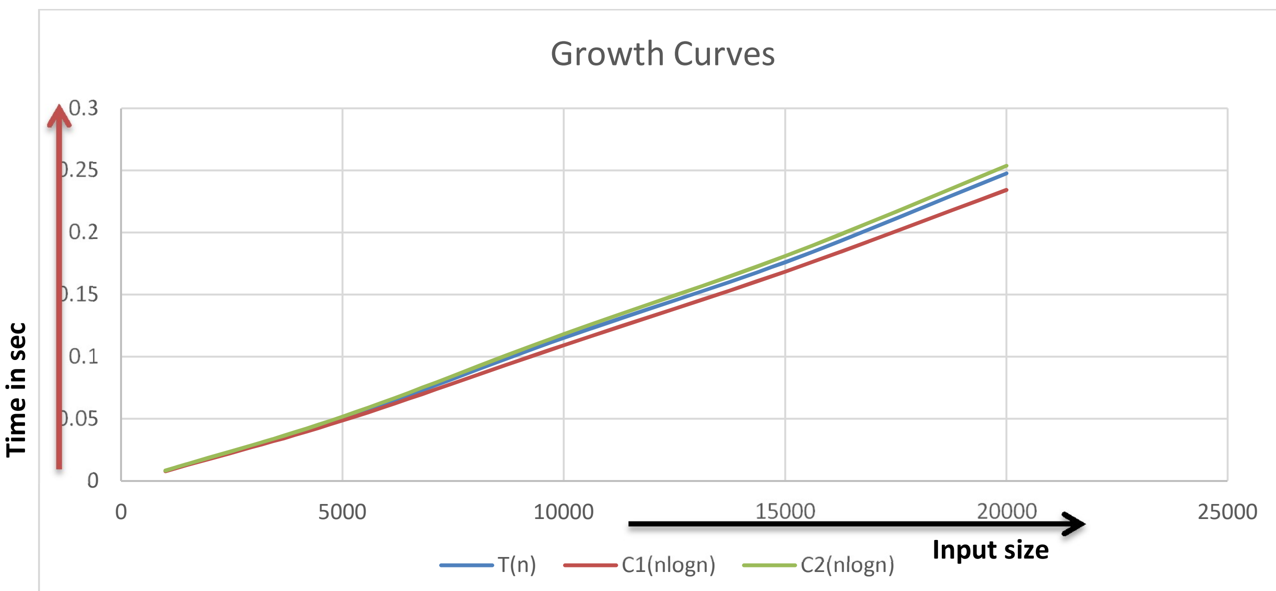
Tabulation of Upper and lower bound asymptotes

Here n = no of elements

T(n) = Time Complexity

C_1nlogn = Lower Bound

C_2nlogn = Upper Bound



**

**keep in mind that your reading will depend on your computer's speed. The above tables and graphs are just for the verification of concepts*

Laboratory Session No. 07

Objective:

Introduction to object oriented programming (OOP), creating classes and objects

SIGNIFICANCE of OOP:

Object-oriented programming is often the most natural approach, once we get the hang of it. OOP languages allow us to break down our software into bite-sized problems that we then can solve — one object at a time. This isn't to say that OOP is the One True Way. However, the advantages of object-oriented programming are many. When you need to solve complex programming challenges and want to add code tools to your skill set, OOP is your friend and has much greater longevity and utility. The concept of data classes allows a programmer to create any new data type that is not already defined in the language itself. The concept of a data class makes it possible to define subclasses of data objects that share some or all of the main class characteristics called inheritance, this property of OOP forces a more thorough data analysis, reduces development time, and ensures more accurate coding.

CONCEPT OF CLASS AND OBJECT:

A *class* is a template or set of instructions to build a specific type of object. Every object is built from a class. Each class should be designed and programmed to accomplish one, and only one, thing. An object's properties are what it knows and its methods are what it can do.

2) CLASSES IN PYTHON:

We can use classes in python in order to save data. We can also access or call the data from different operation when needed.

```
In [4]: class Student():
            '''A student with name, roll number and CGPA'''
            pass

In [7]: t=Student()

In [8]: type (t)
Out[8]: __main__.Student
```

Class creation in Python

In the above the making of a general class is shown. Now we are going to use data in the class. The following shows the calling and saving of the data.

```
In [9]:  t.name='Subhan'

In [10]: t.roll=156

In [11]: t.cgpa=3.0

In [13]: t.name,t.roll,t.cgpa
Out[13]: ('Subhan', 156, 3.0)
```

Assigning attributes

3) USE OF __init__ FUNCTION IN PYTHON:

When a new instance of a python class is created, it is the __init__ method which is called and proves to be a very good place where we can modify the object after it has been created. There is no explicit variable declaration in Python. They spring into action on the first assignment. The use of self makes it easier to distinguish between instance attributes from local variables. Normal attributes are introduced in the __init__ method, but some attributes of a class hold for *all* instances in all cases. Following example can be used to understand __init__ and self construct:

```
In [14]: class Student():
             def __init__(Student, nam, cgp, rol):
                 Student.name = nam
                 Student.cgpa = cgp
                 Student.roll = rol
             def name_print(Student):
                 '''Print the name of the student.'''
                 print("The name assigned is",self.name)
             def cgpa_print(Student):
                 '''Print the name of the student.'''
                 print("The cgpa of",self.name, 'is', Student.cgpa)
             def all_print(Student):
                 '''Print the name of the student.'''
                 print(Student.name, 'has roll #',Student.roll,'and cgpa equals to', Student.cgpa)
```

inint function usage

Now after using the constructor the making and calling of the data become easier.

```
In [15]: a=Student('Subhan',3.0,156)
         b= Student('Humayun',4.0,150)
         c = Student('Osama',2.5,140)
         d = Student('Bilal',2.8,167)

In [16]: b.all_print()

         Humayun has roll # 150 and cgpa equals to 4.0

In [17]: a.all_print()

         Subhan has roll # 156 and cgpa equals to 3.0
```

Creating objects with attributes

Laboratory Session No. 08

Objective:

To implement the following open-ended problem in python

Develop a system which can perform following basic banking related tasks

a) ***Customer account could be created with name, NIC, account number and initial balance. All such attributes should be placed in a class***
b) ***Balance of any costumer could be updated***
c) ***Customer data could be sorted name wise and balance wise(any previously used sorting procedure may be applied)***

Laboratory Session No. 09

Objective:

To implement fundamental data structures in Python (using list)

Note:

Using *list* in python, implement the following

a) Stacks(push and pop operations)
b) Queues(enqueue and dequeuer operations)
c) A dynamic set ‘S’ having following functionalities
   a. Search (S, key)
   b. Insert (an object)
   c. Delete (an object)
   d. Minimum(S)
   e. Maximum(S)

a) Stacks (push and pop operations):

Stack is a linear data structure which follows a particular order in which the operations are performed. The order may be LIFO (Last in First Out) or FILO (First in Last Out). The code of the stack is given below for push and pop operations.

Implementation in Python

```
class stack():
  def __init__(self):
     self.stack=list()
  def push(self,data):
     self.stack.insert(0,data)
  def pop(self):
       print(self.stack[0])
       self.stack.remove(self.stack[0])
```

Python code for class *STACK*

b) Queues (enqueue and dequeuer operations):

A Queue is a linear structure which follows a particular order in which the operations are performed. The order is First-In-First-Out (FIFO). A good example of a queue is any queue of consumers for a resource where the consumer that came first is served first. The difference between stacks and queues is in removing. In a stack we remove the item the most recently added; in a queue, we remove the item the least recently added. The code of queue is given under

Implementation in Python

```
class queue():
  def __init__(self):
    self.queue=list()
  def enqueue(self,data):
    self.queue.insert(0,data)
  def dequeue(self):
    n=len(self.queue)
    print(self.queue[n-1])
    self.queue.remove(self.queue[n-1])
```

Python code for *QUEUE*

c) A dynamic Set

Dynamic set may refer to: A set (abstract data type) that supports insertion and/or deletion of elements. This data structure is frequently used in database access. The code for various performing operation of the dynamic set is provided below

Implementation in Python

```
class ds():
   l=list()
   def add(self,data):
      ds.l.append(data)
      print(ds.l)
   def delete(self,data):
      ds.l.remove(data)
      print(ds.l)
   def search(self,key):
      flag=0
      for i in range(len(ds.l)):
         if ds.l[i]==key:
            flag=1
      return flag
   def min(self):
      for j in range(1,len(ds.l)):
         key=ds.l[j]
         i=j-1
         while i>-1 and ds.l[i]>key:
            ds.l[i+1]=ds.l[i]
            i=i-1
         ds.l[i+1]=key
      print(ds.l[0])
   def max(self):
      n=len(ds.l)
      for j in range(1,len(ds.l)):
         key=ds.l[j]
         i=j-1
```

```
    while i>-1 and ds.l[i]>key:
        ds.l[i+1]=ds.l[i]
        i=i-1
        ds.l[i+1]=key
print(ds.l[n-1])
```

Python code for *DYNAMIC SET*

<u>Note:</u>

Student is now supposed to create objects and perform relevant tasks using those objects for the above classes.

Laboratory Session No. 10

Objective:

Accomplish the following open ended tasks

Using Node class, develop

1. **Stack**
2. **Queues**
3. **Singly connected linked-list with following features**
    a. **Add nodes**
    b. **Traverse all nodes starting from top node**
    c. **Search any key value in all nodes**
    d. **Insert node between any two nodes**

Laboratory Session No. 11

Objective:

Accomplish the open-ended task:

Using Node class, develop singly connected linked-list