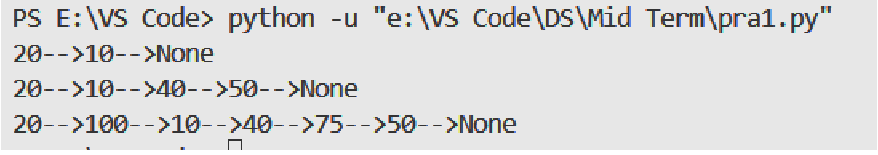
Practical 1:

Apply the DDL algorithm and Create a doubly linked list and perform the following operations: insert from head, insert from tail, insert from specified position and display

Solution:

```
class Node:
    def __init__(self,data):
        self.data=data
        self.prev=None
        self.next=None
class DLL:
    def __init__(self):
        self.head=None
        self.tail=None

    def insert_head(self,data):
        newNode=Node(data)
        if self.head is None:
            self.head=newNode
            self.tail=newNode
        else:
            newNode.next=self.head
            self.head.prev=newNode
            self.head=newNode

    def insert_tail(self,data):
        newNode=Node(data)
        if self.head is None:
            self.head=newNode
            self.tail=newNode
        else:
            self.tail.next=newNode
            newNode.prev=self.tail
            self.tail=newNode

    def insert_spec(self,data,loc):
        newNode=Node(data)
        if self.head is None:
            self.head=newNode
            self.tail=newNode
        elif loc==1:
            self.insert_head(data)
        else:
            cNode=self.head
            cLoc=1
            while cNode is not None and cLoc<loc-1:
                cNode=cNode.next
                cLoc+=1
            newNode.next=cNode.next
            cNode.next.prev=newNode
            newNode.prev=cNode
            cNode.next=newNode

    def display(self):
        temp=self.head
        while temp:
            print(temp.data,end="-->")
            temp=temp.next
        print("None")

dll=DLL()
dll.insert_head(10)
dll.insert_head(20)
dll.display()
dll.insert_tail(40)
dll.insert_tail(50)
dll.display()
dll.insert_spec(100,2)
dll.insert_spec(75,5)
dll.display()
```

output:



```
PS E:\VS Code> python -u "e:\VS Code\DS\Mid Term\pra1.py"
20-->10-->None
20-->10-->40-->50-->None
20-->100-->10-->40-->75-->50-->None
```

Practical 2:

Apply the DDL algorithm and Create doubly linked list and perform the following operations: delete from head, delete from tail, delete from specified position and display

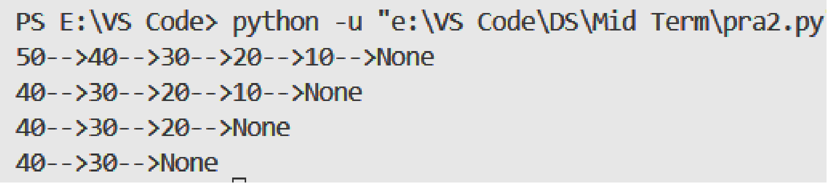
Solution:

```
class Node:
    def __init__(self,data):
        self.data=data
        self.prev=None
        self.next=None
class DLL:
    def __init__(self):
        self.head=None
        self.tail=None

    def insert_head(self,data):
        newNode=Node(data)
        if self.head is None:
            self.head=newNode
            self.tail=newNode
        else:
            newNode.next=self.head
            self.head.prev=newNode
            self.head=newNode

    def del_head(self):
        if self.head is None:
            print("Linked list is Empty")
        else:
            self.head=self.head.next
            self.head.prev=None
```

```
def del_tail(self):
    if self.head is None:
        print("Linked list is Empty")
    else:
        self.tail=self.tail.prev
        self.tail.next.prev=None
        self.tail.next=None

def del_spec(self,loc):
    if self.head is None:
        print("Linked list is Empty")
    elif loc==1:
        self.del_head()
    else:
        cNode=self.head
        cLoc=1
        while cNode is not None and cLoc<loc-1:
            cNode=cNode.next
            cLoc+=1
        if cNode.next.next:
            cNode.next=cNode.next.next
            cNode.next.prev=cNode
        else:
            cNode.next=None

def display(self):
    temp=self.head
    while temp:
        print(temp.data,end="-->")
        temp=temp.next
    print("None")
```

```
dll=DLL()
dll.insert_head(10)
dll.insert_head(20)
dll.insert_head(30)
dll.insert_head(40)
dll.insert_head(50)
dll.display()
dll.del_head()
dll.display()
dll.del_tail()
dll.display()
dll.del_spec(3)
dll.display()
```

Output:



```
PS E:\VS Code> python -u "e:\VS Code\DS\Mid Term\pra2.py
50-->40-->30-->20-->10-->None
40-->30-->20-->10-->None
40-->30-->20-->None
40-->30-->None
```

Practical 3:

Apply the SLL algorithm and Create Circular Singly linked list and perform the following operations: insert from head, insert from tail, insert from specified position and display

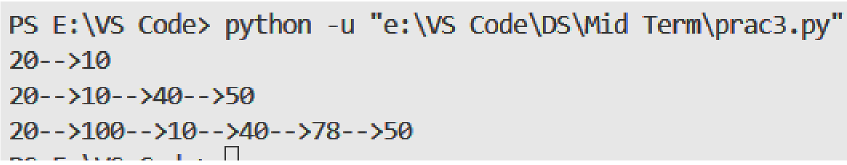
Solution:

```
class node:
    def __init__(self,data):
        self.data=data
        self.next=None

class circlList:
    def __init__(self):
        self.head=None

    def insert_beg(self,data):
        newNode = node(data)
        if self.head==None:
            self.head=newNode
            newNode.next=self.head
        else:
            cNode=self.head
            while cNode.next != self.head:
                cNode=cNode.next
            newNode.next=self.head
            self.head=newNode
            cNode.next=self.head

    def insert_end(self,data):
        newNode=node(data)
        if self.head==None:
            self.head=newNode
            newNode.next=self.head
        else:
```

```
        cNode=self.head
        while cNode.next != self.head:
            cNode=cNode.next
        cNode.next=newNode
        newNode.next=self.head

def insert_spec(self,data,loc):
    newNode=node(data)
    if self.head==None:
        self.head=newNode
        newNode.next=self.head
    elif loc==1:
        self.insert_beg(data)
    else:
        cNode=self.head
        cLoc=1
        while cNode.next!=self.head and cLoc<loc-1:
            cNode=cNode.next
            cLoc=cLoc+1
        newNode.next=cNode.next
        cNode.next=newNode

def display(self):
    if self.head==None:
        print("Linked list is empty: ")
    else:
        cNode=self.head
        while cNode.next!=self.head:
            print(cNode.data,end="-->")
            cNode=cNode.next
        print(cNode.data)
```

```
cl = circlList()
cl.insert_beg(10)
cl.insert_beg(20)
cl.display()
cl.insert_end(40)
cl.insert_end(50)
cl.display()
cl.insert_spec(100,2)
cl.insert_spec(78,4)
cl.display()
```

Output:



```
PS E:\VS Code> python -u "e:\VS Code\DS\Mid Term\prac3.py"
20-->10
20-->10-->40-->50
20-->100-->10-->40-->78-->50
PS E:\VS Code>
```

Practical 4:

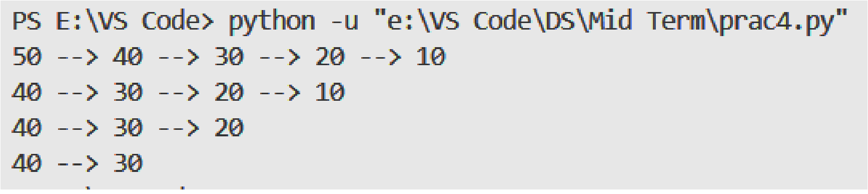
Apply the Circular SLL algorithm and Create Circular Singly linked list and perform the following operations: delete from head, delete from tail , delete from specified position and display

Solution:

```
class node:
   def __init__(self, data):
      self.data = data
      self.next = None


class circlList:
   def __init__(self):
      self.head = None


   def insert_beg(self, data):
      newNode = node(data)
      if self.head is None:
         self.head = newNode
         newNode.next = self.head
      else:
         cNode = self.head
         while cNode.next != self.head:
            cNode = cNode.next
         newNode.next = self.head
         self.head = newNode
         cNode.next = self.head


   def delete_spec(self, loc):
      if self.head is None:
         print("Linked list is already empty")
         return
      if self.head.next == self.head and loc == 1:
         self.head = None
         print("After deletion, the list is empty")
         return
      if loc == 1:
         self.delete_beg()
         return
      cNode = self.head
      cLoc = 1
      while cNode.next != self.head and cLoc < loc - 1:
         cNode = cNode.next
         cLoc += 1
      if cNode.next == self.head:
         print("Position out of range")
         return
      cNode.next = cNode.next.next

   def delete_beg(self):
      if self.head is None:
         print("Linked list is already empty")
         return
      if self.head.next == self.head:
         self.head = None
         print("After deletion, the list is empty")
         return
      cNode = self.head
      while cNode.next != self.head:
         cNode = cNode.next
      self.head = self.head.next
      cNode.next = self.head

   def delete_end(self):
      if self.head is None:
         print("Linked list is already empty")
         return
      if self.head.next == self.head:
         self.head = None
         print("After deletion, the list is empty")
         return
      cNode = self.head
      while cNode.next.next != self.head:
         cNode = cNode.next
      cNode.next = self.head

   def display(self):
      if self.head is None:
         print("Linked list is empty")
         return
      cNode = self.head
      while cNode.next != self.head:
         print(cNode.data, end=" --> ")
         cNode = cNode.next
      print(cNode.data)
```

```
cl = circlList()
cl.insert_beg(10)
cl.insert_beg(20)
cl.insert_beg(30)
cl.insert_beg(40)
cl.insert_beg(50)
cl.display()
cl.delete_beg()
cl.display()
cl.delete_end()
cl.display()
cl.delete_spec(3)
cl.display()
```

Output:



```
PS E:\VS Code> python -u "e:\VS Code\DS\Mid Term\prac4.py"
50 --> 40 --> 30 --> 20 --> 10
40 --> 30 --> 20 --> 10
40 --> 30 --> 20
40 --> 30
```

Practical 5:

Apply the circular DLL algorithm and Create Circular Doubly linked list and perform the following operations: insert from head, insert from tail, insert from specified position and display

Solution:

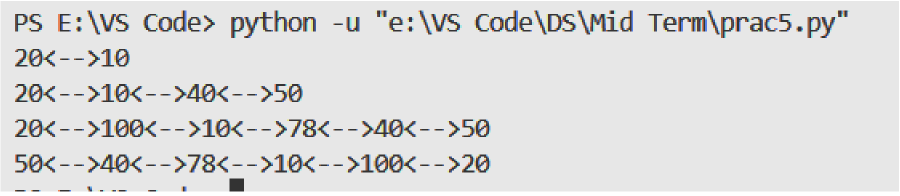
```
# Apply the Circular DLL algorithm and Create Circular Doubly

# linked list and perform the following operations: insert from

# head, insert from tail , insert from specified position and display


class node:
    def __init__(self,data):
        self.data=data
        self.next=None
        self.prev=None


class circlList:
    def __init__(self):
        self.head=None


    def insert_beg(self,data):
        newNode = node(data)
        if self.head==None:
            self.head=newNode
            newNode.next=self.head
            newNode.prev=self.head
        else:
            cNode=self.head
            while cNode.next != self.head:
```

```
            cNode=cNode.next
        newNode.next=self.head
        newNode.prev=cNode
        self.head=newNode
        cNode.next=self.head

    def insert_end(self,data):
        newNode=node(data)
        if self.head==None:
            self.head=newNode
            newNode.next=self.head
        else:
            cNode=self.head
            while cNode.next != self.head:
                cNode=cNode.next
            newNode.prev=cNode
            cNode.next=newNode
            newNode.next=self.head

    def insert_spec(self,data,loc):
        newNode=node(data)
        if self.head==None:
            self.head=newNode
            newNode.next=self.head
            newNode.prev=self.head
        elif loc==1:
            self.insert_beg(data)
        else:
```

```
    cNode=self.head
    cLoc=1
    while cNode.next!=self.head and cLoc<loc-1:
      cNode=cNode.next
      cLoc=cLoc+1
    newNode.next=cNode.next
    cNode.next.prev=newNode
    cNode.next=newNode
    newNode.prev=cNode

def display(self):
  if self.head==None:
    print("Linked list is empty: ")
  else:
    cNode=self.head
    while cNode.next!=self.head:
      print(cNode.data,end="<-->")
      cNode=cNode.next
    print(cNode.data)

def display_rev(self):
  if self.head == None:
    print("Linked list is empty")
  else:
    cNode = self.head
    while cNode.next != self.head:
      cNode = cNode.next
    temp = cNode
```

```
        while temp != self.head:
            print(temp.data, end="<-->")
            temp = temp.prev
        print(temp.data)

cl = circlList()
cl.insert_beg(10)
cl.insert_beg(20)
cl.display()
cl.insert_end(40)
cl.insert_end(50)
cl.display()
cl.insert_spec(100,2)
cl.insert_spec(78,4)
cl.display()
cl.display_rev()
```

Output:



```
PS E:\VS Code> python -u "e:\VS Code\DS\Mid Term\prac5.py"
20<-->10
20<-->10<-->40<-->50
20<-->100<-->10<-->78<-->40<-->50
50<-->40<-->78<-->10<-->100<-->20
```

Practical 6:

Apply the Circular DLL algorithm and Create Circular Doubly linked list and perform the following operations: delete from head, delete from tail, delete from specified position and display

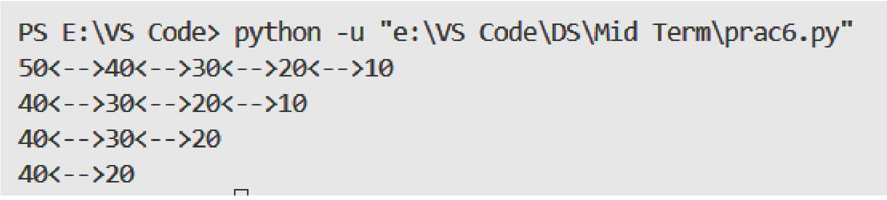
Solution:

```
class node:
   def __init__(self, data):
      self.data = data
      self.next = None
      self.prev = None

class circlList:
   def __init__(self):
      self.head = None

   def insert_beg(self, data):
      newNode = node(data)
      if self.head == None:
         self.head = newNode
         newNode.next = self.head
         newNode.prev = self.head
      else:
         cNode = self.head
         while cNode.next != self.head:
            cNode = cNode.next
         newNode.next = self.head
         newNode.prev = cNode
         self.head.prev = newNode
         self.head = newNode
```

```
        cNode.next = self.head

def delete_head(self):
    if self.head == None:
        print("Linked list is already empty")
    elif self.head.next == self.head:
        self.head = None
    else:
        cNode = self.head
        while cNode.next != self.head:
            cNode = cNode.next
        self.head = self.head.next
        self.head.prev = cNode
        cNode.next = self.head

def delete_tail(self):
    if self.head == None:
        print("Linked list is already empty")
    elif self.head.next == self.head:
        self.head = None
    else:
        cNode = self.head
        while cNode.next != self.head:
            cNode = cNode.next
        cNode.prev.next = self.head
        self.head.prev = cNode.prev

def delete_spec(self, loc):
        if self.head == None:
            print("Linked list is already empty")
        elif loc == 1:
            self.delete_head()
        else:
            cNode = self.head
            cLoc = 1
            while cNode.next != self.head and cLoc < loc:
                cNode = cNode.next
                cLoc += 1
            if cNode == self.head:
                print("Location exceeds the length of the list")
            else:
                cNode.prev.next = cNode.next
                cNode.next.prev = cNode.prev

    def display(self):
        if self.head == None:
            print("Linked list is empty")
        else:
            cNode = self.head
            while cNode.next != self.head:
                print(cNode.data, end="<-->")
                cNode = cNode.next
            print(cNode.data)


cl = circlList()
```

```
cl.insert_beg(10)
cl.insert_beg(20)
cl.insert_beg(30)
cl.insert_beg(40)
cl.insert_beg(50)
cl.display()
cl.delete_head()
cl.display()
cl.delete_tail()
cl.display()
cl.delete_spec(2)
cl.display()
```

Output:



```
PS E:\VS Code> python -u "e:\VS Code\DS\Mid Term\prac6.py"
50<-->40<-->30<-->20<-->10
40<-->30<-->20<-->10
40<-->30<-->20
40<-->20
```

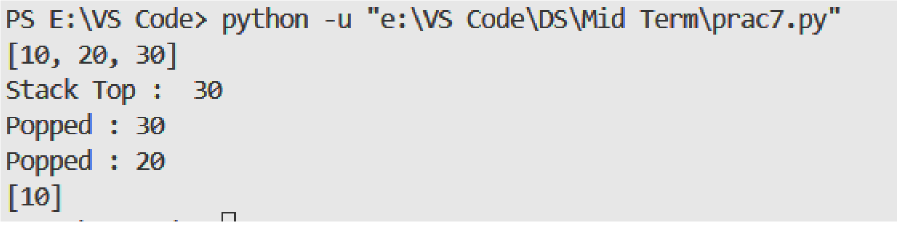
Practical 7:

Apply Stack Algorithm and create Stack using array and perform following operations: Push, POP, Peek

Solution:

```
class Stack:
    def __init__(self):
        self.stack = []

    def push(self, item):
        self.stack.append(item)

    def isEmpty(self):
        return len(self.stack) == 0

    def pop(self):
        if self.isEmpty():
            return("Underflow - Stack is empty")
        else:
            return self.stack.pop()

    def peek(self):
        if self.isEmpty():
            return("Underflow - Stack is empty")
        else:
            return self.stack[-1]

    def display(self):
        if self.isEmpty():
            return("Underflow - Stack is empty")
        else:
            print(self.stack)

s=Stack()
s.push(10)
s.push(20)
s.push(30)
s.display()
print("Stack Top : ",s.peek())
print("Popped :",s.pop())
print("Popped :",s.pop())
s.display()
```

Output:



```
PS E:\VS Code> python -u "e:\VS Code\DS\Mid Term\prac7.py"
[10, 20, 30]
Stack Top :  30
Popped : 30
Popped : 20
[10]
```

Practical 8:

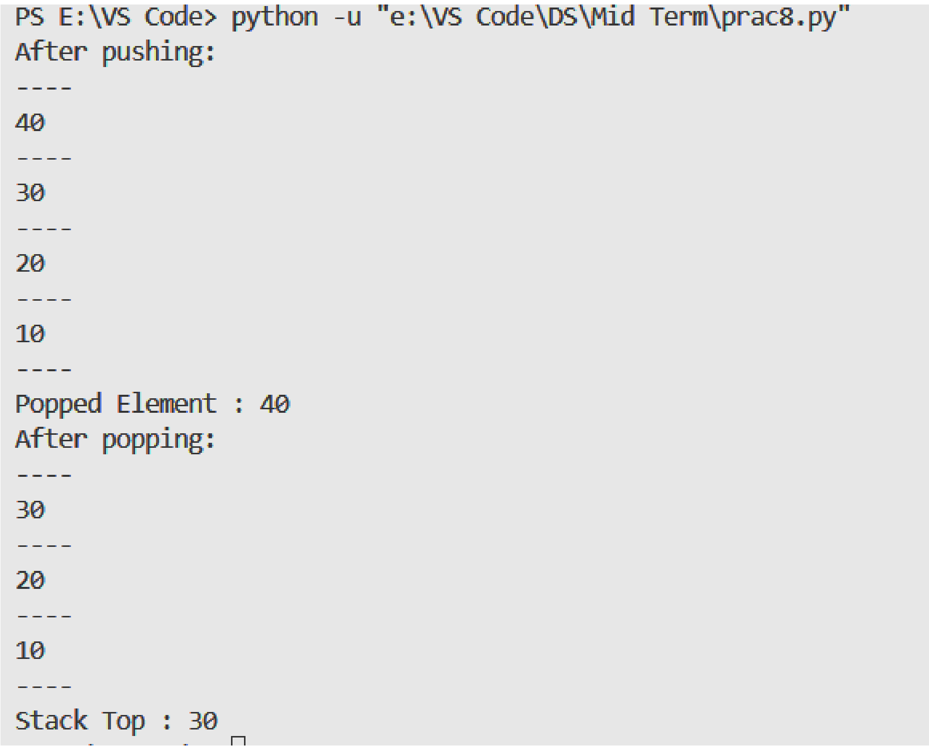
Apply Stack Algorithm and create Stack using linked list and perform following operations: Push, POP, Peek

Solution:

```
# Apply Stack Algorithm and create Stack using linked list and
# perform following operations: Push, POP, Peek

class Node:
    def __init__(self, data):
        self.data = data
        self.next=None

class Stack:
    def __init__(self):
        self.top=None

    def push(self,data):
        newNode=Node(data)
        if self.top is None:
            self.top=newNode
        else:
            newNode.next=self.top
            self.top=newNode

    def pop(self):
        if self.top is None:
            return "Stack is empty"
        else:
            popped_node=self.top
            self.top=self.top.next
            popped_node.next=None
            return popped_node.data

    def peek(self):
        if self.top is None:
            return "Stack is empty"
        else:
            return self.top.data

    def display(self):
        if self.top is None:
            print("Stack is Empty")
        else:
            temp = self.top
            print("----")
            while temp:
                print(temp.data)
                print("----")
                temp=temp.next

s=Stack()
s.push(10)
s.push(20)
s.push(30)
s.push(40)
print("After pushing: ")
s.display()
```

```
print("Popped Element :",s.pop())

print("After popping: ")

s.display()

print("Stack Top :",s.peek())
```

Output:



```
PS E:\VS Code> python -u "e:\VS Code\DS\Mid Term\prac8.py"
After pushing:
----
40
----
30
----
20
----
10
----
Popped Element : 40
After popping:
----
30
----
20
----
10
----
Stack Top : 30
```