Experiment No. 6
Program for data structure using built in function for link list, stack and queues
Date of Performance:
Date of Submission:

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Title: Program for data structure using built in function for link list, stack and queues

Aim: To study and implement data structure using built in function for link list, stack and queues

Objective: To introduce data structures in python

Theory:

Stacks -the simplest of all data structures, but also the most important. A stack is a collection of objects that are inserted and removed using the LIFO principle. LIFO stands for "Last In First Out". Because of the way stacks are structured, the last item added is the first to be removed, and vice-versa: the first item added is the last to be removed.

Queues – essentially a modified stack. It is a collection of objects that are inserted and removed according to the FIFO (First In First Out) principle. Queues are analogous to a line at the grocery store: people are added to the line from the back, and the first in line is the first that gets checked out – BOOM, FIFO!

Linked Lists

The Stack and Queue representations I just shared with you employ the python-based list to store their elements. A python list is nothing more than a dynamic array, which has some disadvantages.

The length of the dynamic array may be longer than the number of elements it stores, taking up precious free space.

Insertion and deletion from arrays are expensive since you must move the items next to them over

Using Linked Lists to implement a stack and a queue (instead of a dynamic array) solve both of these issues; addition and removal from both of these data structures (when implemented with a linked list) can be accomplished in constant O(1) time. This is a HUGE advantage when dealing with lists of millions of items.

Linked Lists – comprised of 'Nodes'. Each node stores a piece of data and a reference to its next and/or previous node. This builds a linear sequence of nodes. All Linked Lists store a head, which is a reference to the first node. Some Linked Lists also store a tail, a reference to the last node in the list.

CODE:

STACK-

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

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

    def pop(self):
        if self.is_empty():
            return None
        return self.stack.pop()

    def peek(self):
        if self.is_empty():
            return None
        return self.stack[-1]


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


    def size(self):
        return len(self.stack)


    def display(self):
        if self.is_empty():
            print("Stack is empty.")
        else:
            print("Current stack:")
            print("\n".join(map(str, self.stack[::-1])))



def main():
    stack = Stack()


    while True:
        print("\nStack Operations:")
print("1. Push")

print("2. Pop")

print("3. Peek")

print("4. Size")

print("5. Display Stack")

print("6. Exit")


choice = input("Enter your choice (1-6): ")


if choice == '1':

    item = input("Enter item to push: ")

    stack.push(item)

    print(f"{item} pushed to stack.")

elif choice == '2':

    item = stack.pop()

    if item is not None:

        print(f"Popped item: {item}")

    else:

        print("Stack is empty.")

elif choice == '3':

    item = stack.peek()

    if item is not None:
```

```
                print(f"Top item: {item}")

            else:

                print("Stack is empty.")

        elif choice == '4':

            print("Size of stack:", stack.size())

        elif choice == '5':

            stack.display()

        elif choice == '6':

            print("Exiting...")

            break

        else:

            print("Invalid choice. Please enter a number between 1 and 6.")




if __name__ == "__main__":

    main()
```

QUEUE-

```
class Queue:

    def __init__(self):

        self.queue = []
```

```
def enqueue(self, item):
    self.queue.append(item)


def dequeue(self):
    if self.is_empty():
        return None
    return self.queue.pop(0)


def peek(self):
    if self.is_empty():
        return None
    return self.queue[0]
def is_empty(self):
    return len(self.queue) == 0
def size(self):
    return len(self.queue)


def display(self):
    if self.is_empty():
        print("Queue is empty.")
    else:
        print("Current queue:")
```

```
            print(" ".join(map(str, self.queue)))

def main():

    queue = Queue()

    while True:

        print("\nQueue Operations:")

        print("1. Enqueue")

        print("2. Dequeue")

        print("3. Peek")

        print("4. Size")

        print("5. Display Queue")

        print("6. Exit")

        choice = input("Enter your choice (1-6): ")

        if choice == '1':

            item = input("Enter item to enqueue: ")

            queue.enqueue(item)

            print(f"{item} enqueued.")

        elif choice == '2':

            item = queue.dequeue()

            if item is not None:

                print(f"Dequeued item: {item}")

            else:

                print("Queue is empty.")
        elif choice == '3':
            item = queue.peek()
            if item is not None:
                print(f"Front item: {item}")
            else:
                print("Queue is empty.")
        elif choice == '4':
            print("Size of queue:", queue.size())
        elif choice == '5':
            queue.display()
        elif choice == '6':
            print("Exiting...")
            break
        else:
            print("Invalid choice. Please enter a number between 1 and 6.")
if __name__ == "__main__":
    main()
```

LINK LIST-

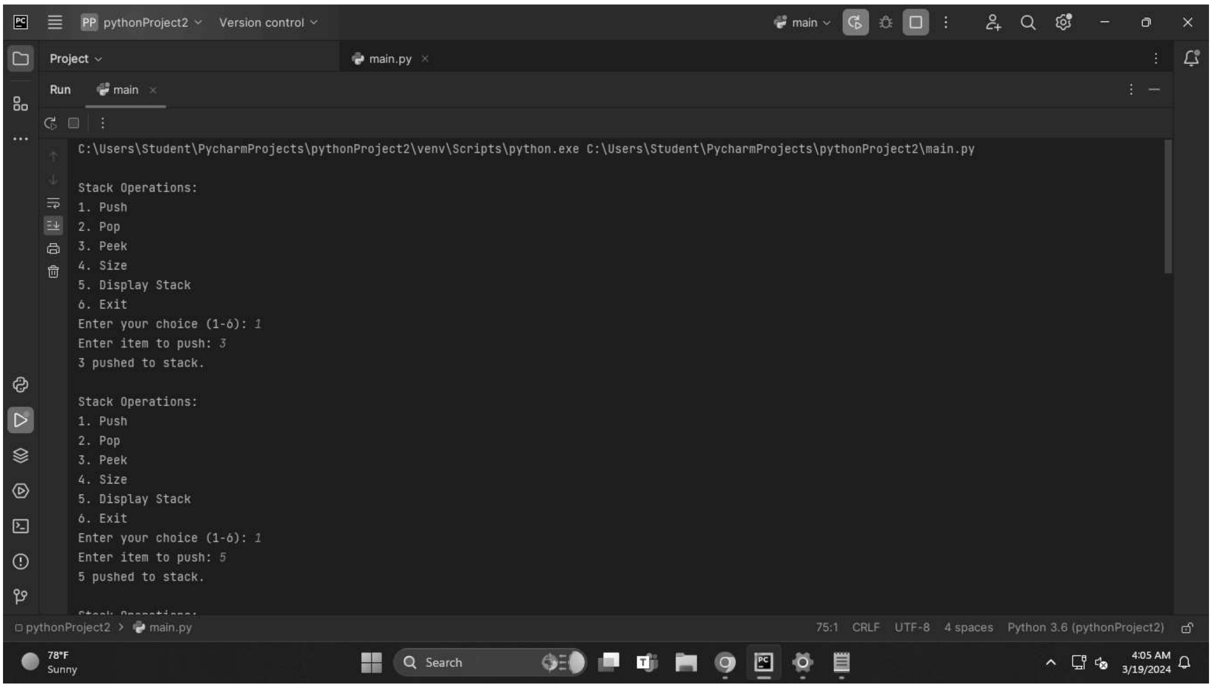
```
class Node:
    def __init__(self, data):
        self.data = data
        self.next = None
class LinkedList:
    def __init__(self):
        self.head = None
    def insert_at_beginning(self, data):
        new_node = Node(data)
        new_node.next = self.head
        self.head = new_node

    def insert_at_end(self, data):
        new_node = Node(data)
        if self.head is None:
            self.head = new_node
            return
        last_node = self.head
        while last_node.next:
            last_node = last_node.next
        last_node.next = new_node

    def delete_node(self, key):
        temp = self.head
        if temp is not None:
            if temp.data == key:
```

```
            self.head = temp.next
            temp = None
            return
    while temp is not None:
        if temp.data == key:
            break
        prev = temp
        temp = temp.next
    if temp == None:
        return
    prev.next = temp.next
    temp = None

def search(self, key):
    current = self.head
    while current:
        if current.data == key:
            return True
        current = current.next
    return False

def display(self):
    current = self.head
```

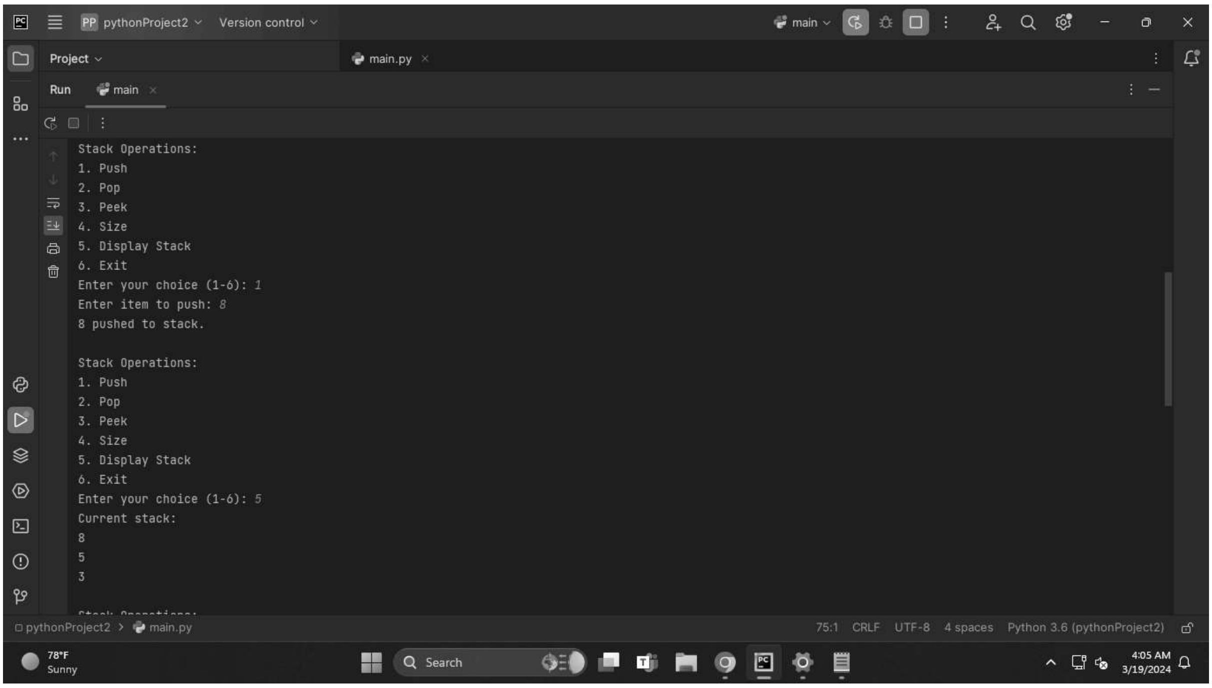
```
        while current:
            print(current.data, end=" -> ")
            current = current.next
        print("None")


# Main function
if __name__ == "__main__":
    linked_list = LinkedList()

    while True:
        print("\nLinked List Operations:")
        print("1. Insert at beginning")
        print("2. Insert at end")
        print("3. Delete node")
        print("4. Search node")
        print("5. Display linked list")
        print("6. Exit")

        choice = int(input("Enter your choice: "))

        if choice == 1:
            data = int(input("Enter data to insert at beginning: "))
    linked_list.insert_at_beginning(data)
elif choice == 2:
    data = int(input("Enter data to insert at end: "))
    linked_list.insert_at_end(data)
elif choice == 3:
    key = int(input("Enter data to delete: "))
    linked_list.delete_node(key)
elif choice == 4:
    key = int(input("Enter data to search: "))
    if linked_list.search(key):
        print("Data found in the linked list.")
    else:
        print("Data not found in the linked list.")
elif choice == 5:
    linked_list.display()
elif choice == 6:
    print("Exiting...")
    break
else:
    print("Invalid choice. Please enter a valid option.")
```

RESULTS:

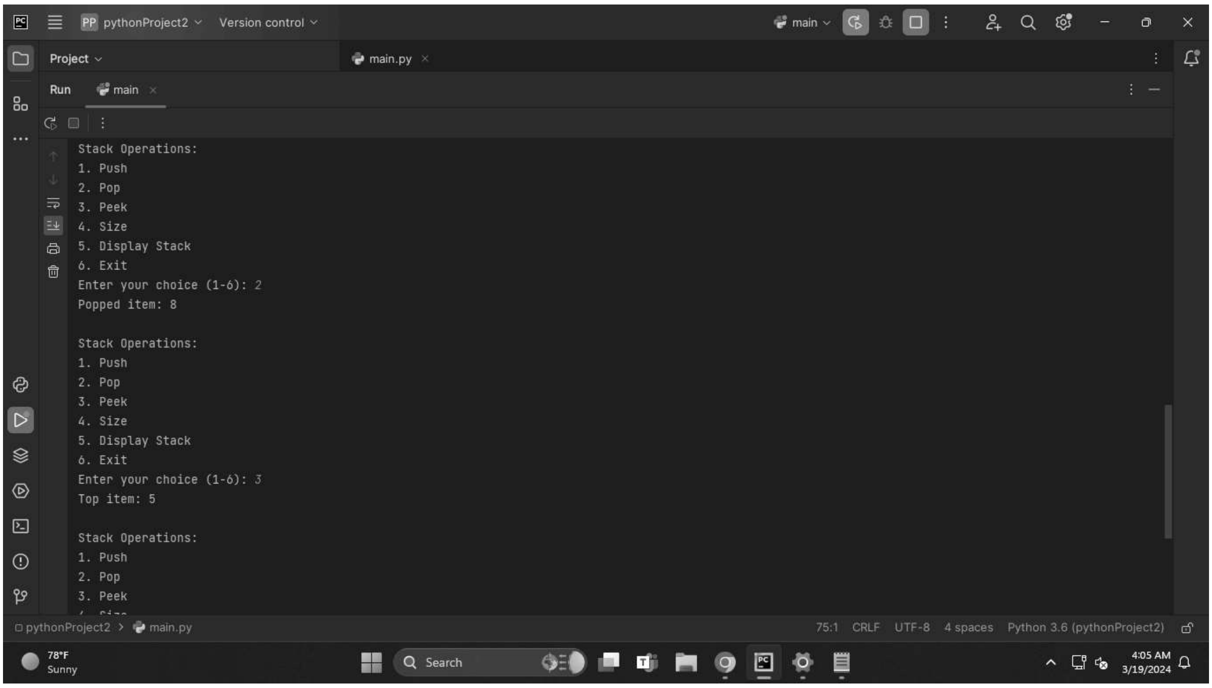
Stack:



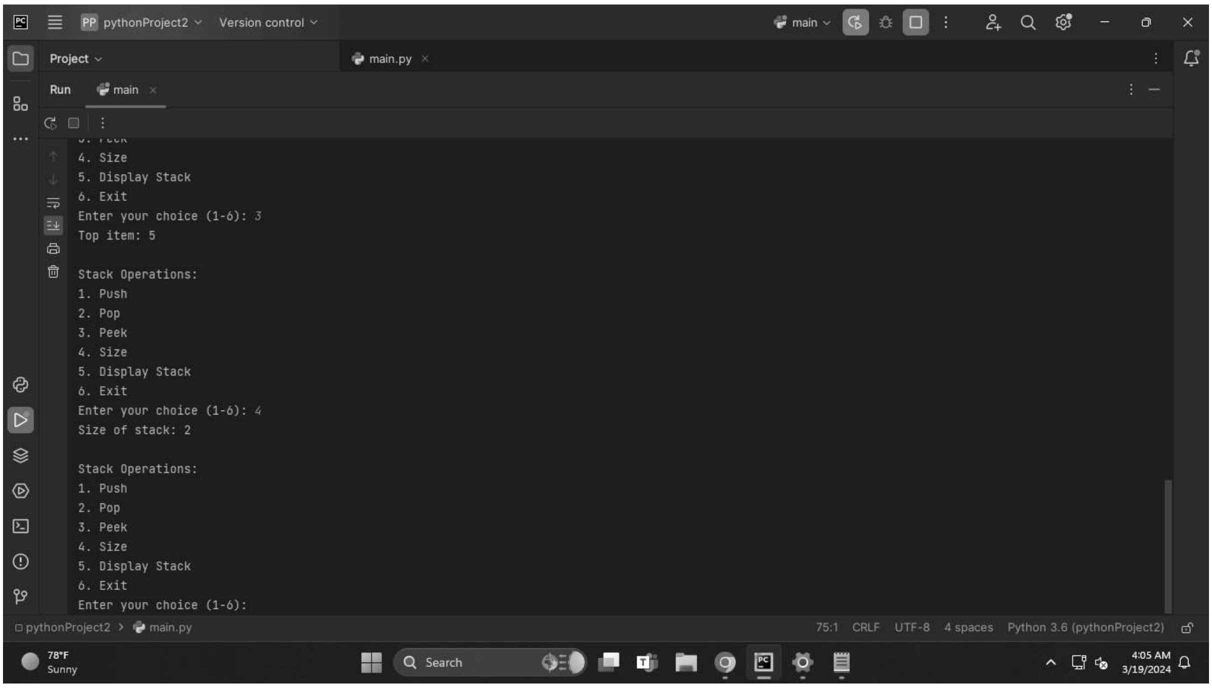
```
C:\Users\Student\PycharmProjects\pythonProject2\venv\Scripts\python.exe C:\Users\Student\PycharmProjects\pythonProject2\main.py

Stack Operations:
1. Push
2. Pop
3. Peek
4. Size
5. Display Stack
6. Exit
Enter your choice (1-6): 1
Enter item to push: 3
3 pushed to stack.

Stack Operations:
1. Push
2. Pop
3. Peek
4. Size
5. Display Stack
6. Exit
Enter your choice (1-6): 1
Enter item to push: 5
5 pushed to stack.

Stack Operations:
```



```
Stack Operations:
1. Push
2. Pop
3. Peek
4. Size
5. Display Stack
6. Exit
Enter your choice (1-6): 1
Enter item to push: 8
8 pushed to stack.

Stack Operations:
1. Push
2. Pop
3. Peek
4. Size
5. Display Stack
6. Exit
Enter your choice (1-6): 5
Current stack:
8
5
3

Stack Operations:
```

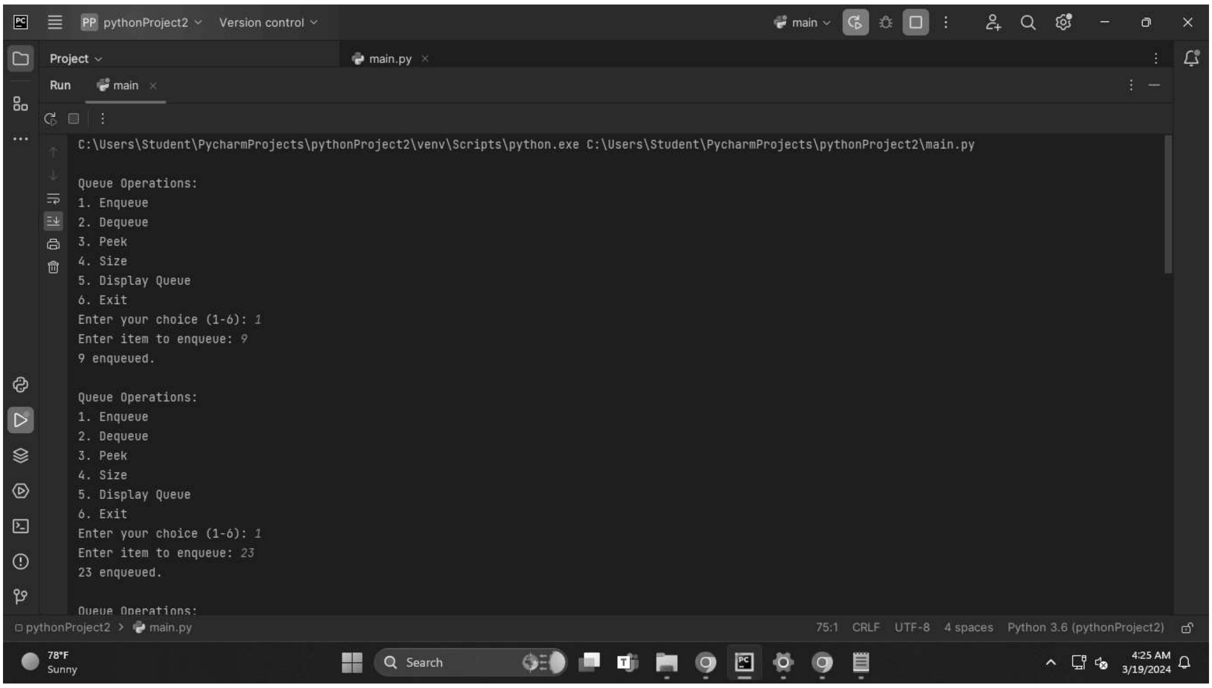


```
Stack Operations:
1. Push
2. Pop
3. Peek
4. Size
5. Display Stack
6. Exit
Enter your choice (1-6): 2
Popped item: 8

Stack Operations:
1. Push
2. Pop
3. Peek
4. Size
5. Display Stack
6. Exit
Enter your choice (1-6): 3
Top item: 5

Stack Operations:
1. Push
2. Pop
3. Peek
```

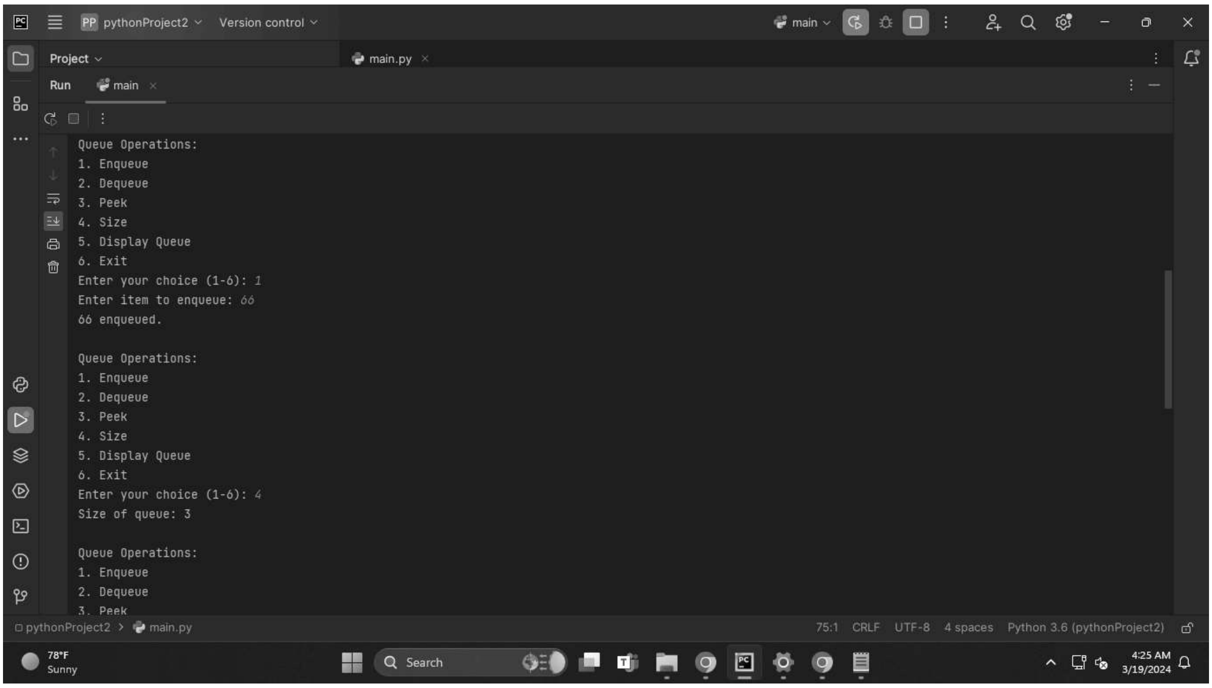


```
4. Size
5. Display Stack
6. Exit
Enter your choice (1-6): 3
Top item: 5

Stack Operations:
1. Push
2. Pop
3. Peek
4. Size
5. Display Stack
6. Exit
Enter your choice (1-6): 4
Size of stack: 2

Stack Operations:
1. Push
2. Pop
3. Peek
4. Size
5. Display Stack
6. Exit
Enter your choice (1-6):
```

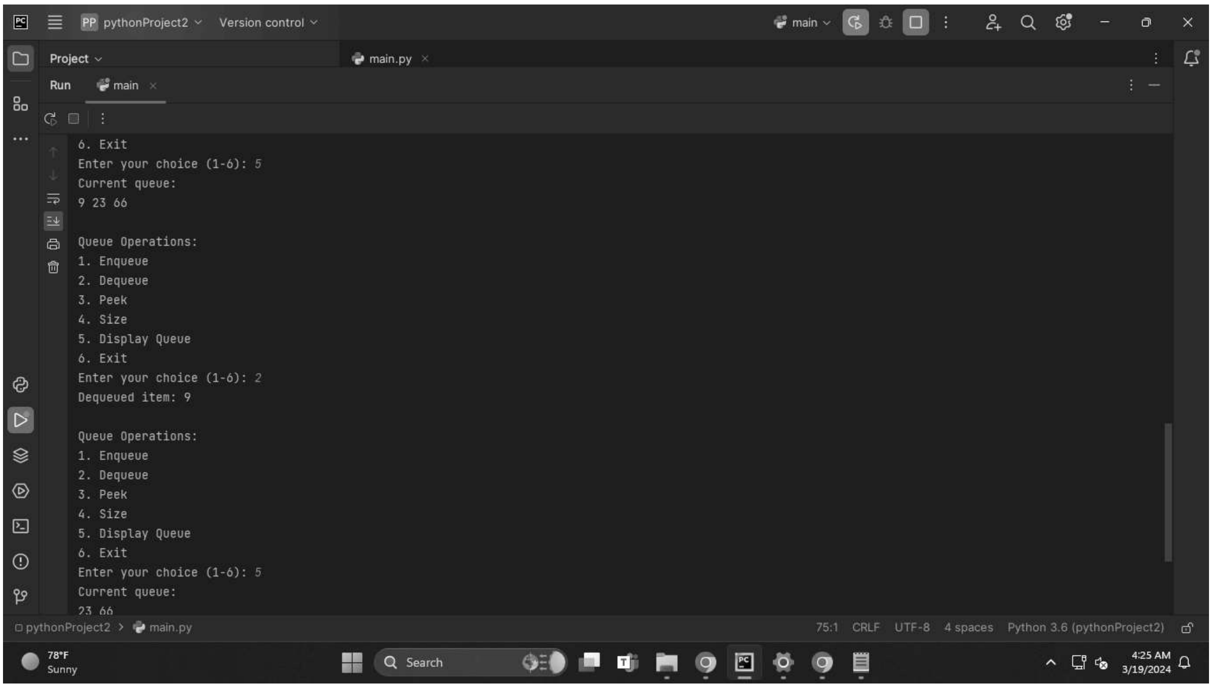
Queue:



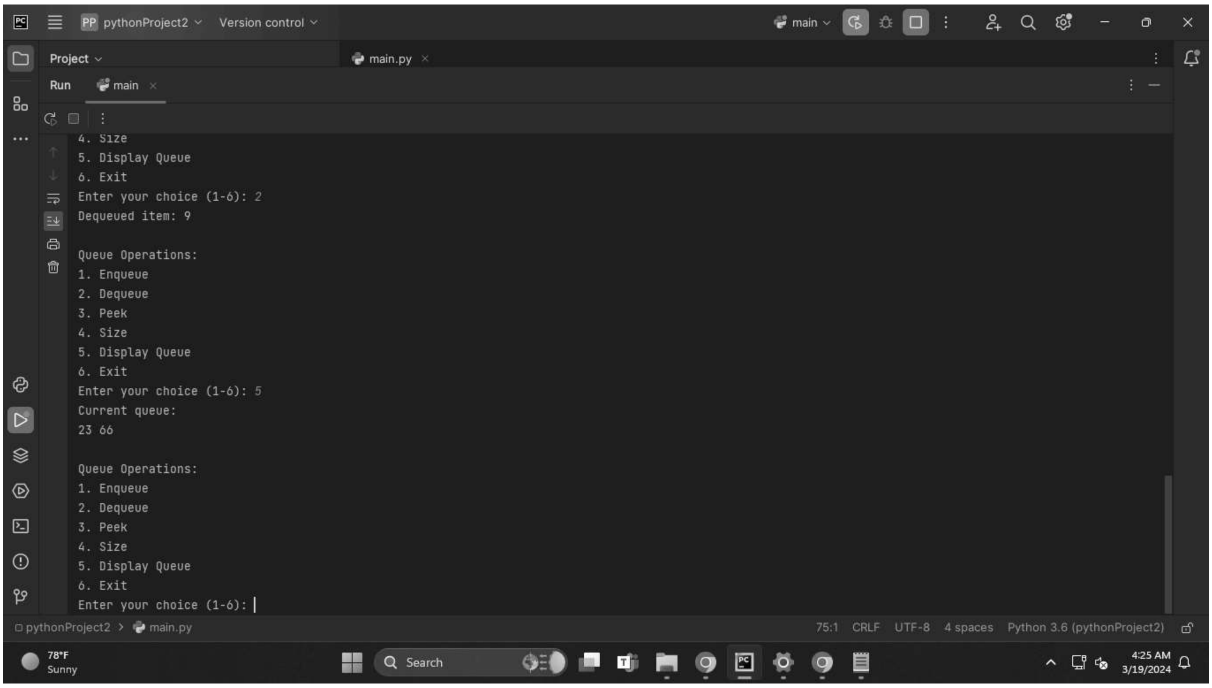
```
C:\Users\Student\PycharmProjects\pythonProject2\venv\Scripts\python.exe C:\Users\Student\PycharmProjects\pythonProject2\main.py

Queue Operations:
1. Enqueue
2. Dequeue
3. Peek
4. Size
5. Display Queue
6. Exit
Enter your choice (1-6): 1
Enter item to enqueue: 9
9 enqueued.

Queue Operations:
1. Enqueue
2. Dequeue
3. Peek
4. Size
5. Display Queue
6. Exit
Enter your choice (1-6): 1
Enter item to enqueue: 23
23 enqueued.

Queue Operations:
```



```
Queue Operations:
1. Enqueue
2. Dequeue
3. Peek
4. Size
5. Display Queue
6. Exit
Enter your choice (1-6): 1
Enter item to enqueue: 66
66 enqueued.

Queue Operations:
1. Enqueue
2. Dequeue
3. Peek
4. Size
5. Display Queue
6. Exit
Enter your choice (1-6): 4
Size of queue: 3

Queue Operations:
1. Enqueue
2. Dequeue
3. Peek
```

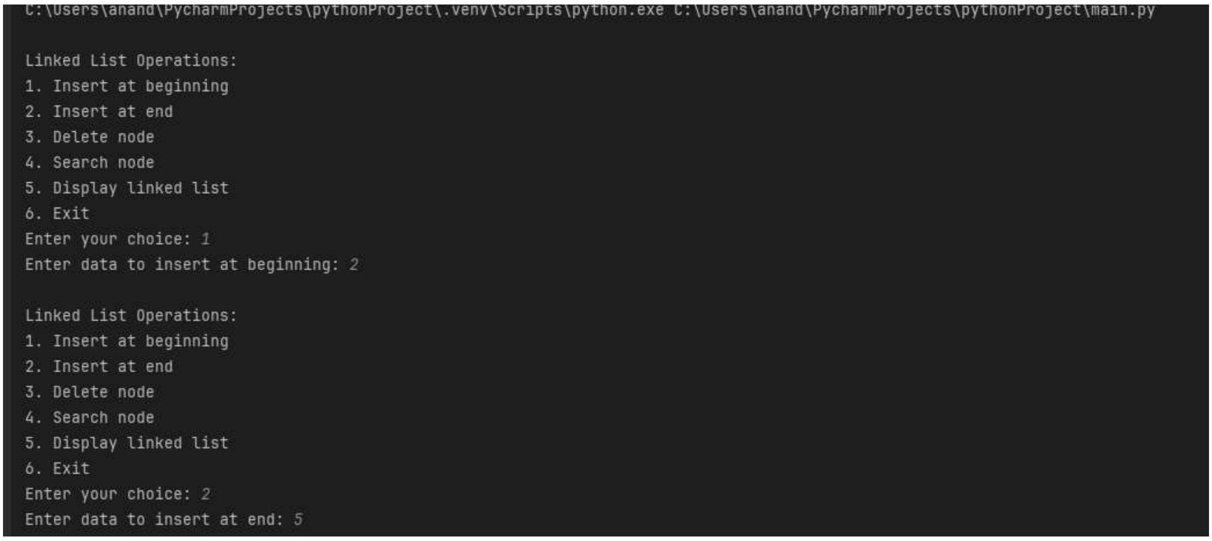


```
6. Exit
Enter your choice (1-6): 5
Current queue:
9 23 66

Queue Operations:
1. Enqueue
2. Dequeue
3. Peek
4. Size
5. Display Queue
6. Exit
Enter your choice (1-6): 2
Dequeued item: 9

Queue Operations:
1. Enqueue
2. Dequeue
3. Peek
4. Size
5. Display Queue
6. Exit
Enter your choice (1-6): 5
Current queue:
23 66
```

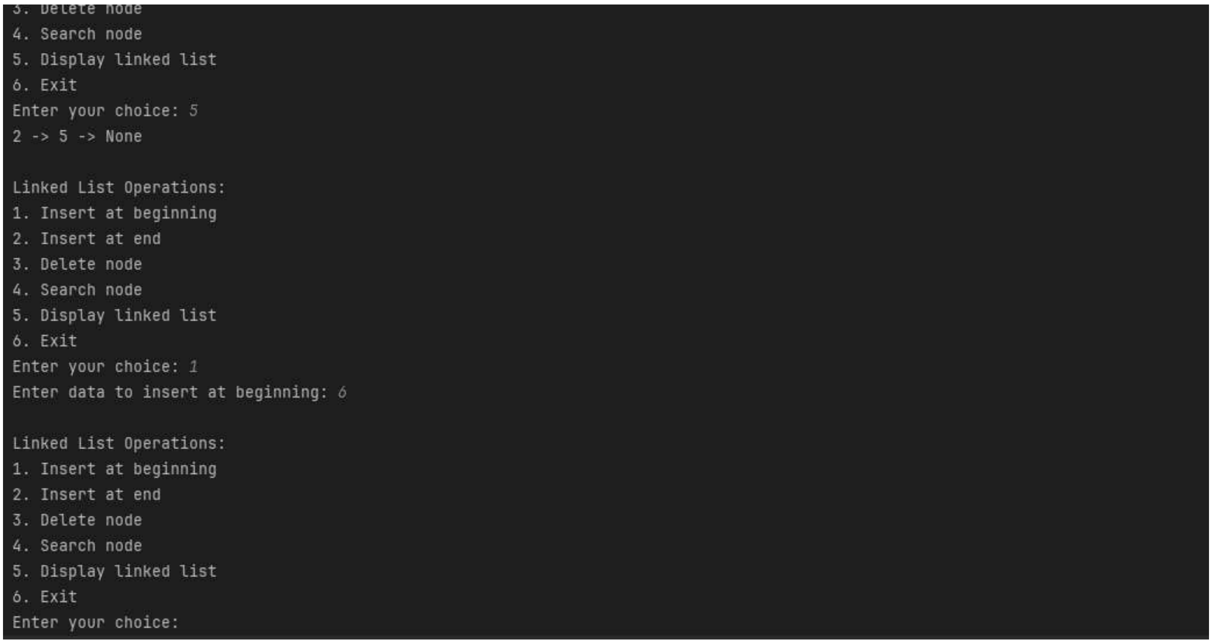


```
4. Size
5. Display Queue
6. Exit
Enter your choice (1-6): 2
Dequeued item: 9

Queue Operations:
1. Enqueue
2. Dequeue
3. Peek
4. Size
5. Display Queue
6. Exit
Enter your choice (1-6): 5
Current queue:
23 66

Queue Operations:
1. Enqueue
2. Dequeue
3. Peek
4. Size
5. Display Queue
6. Exit
Enter your choice (1-6): 
```

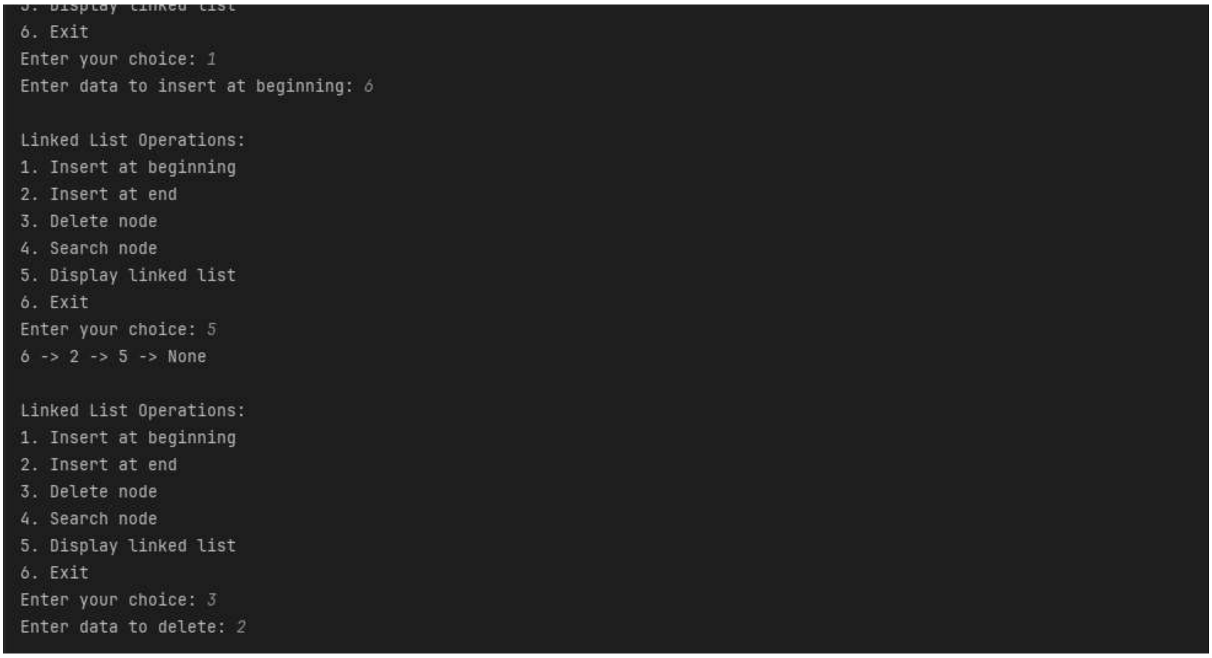
Link list:



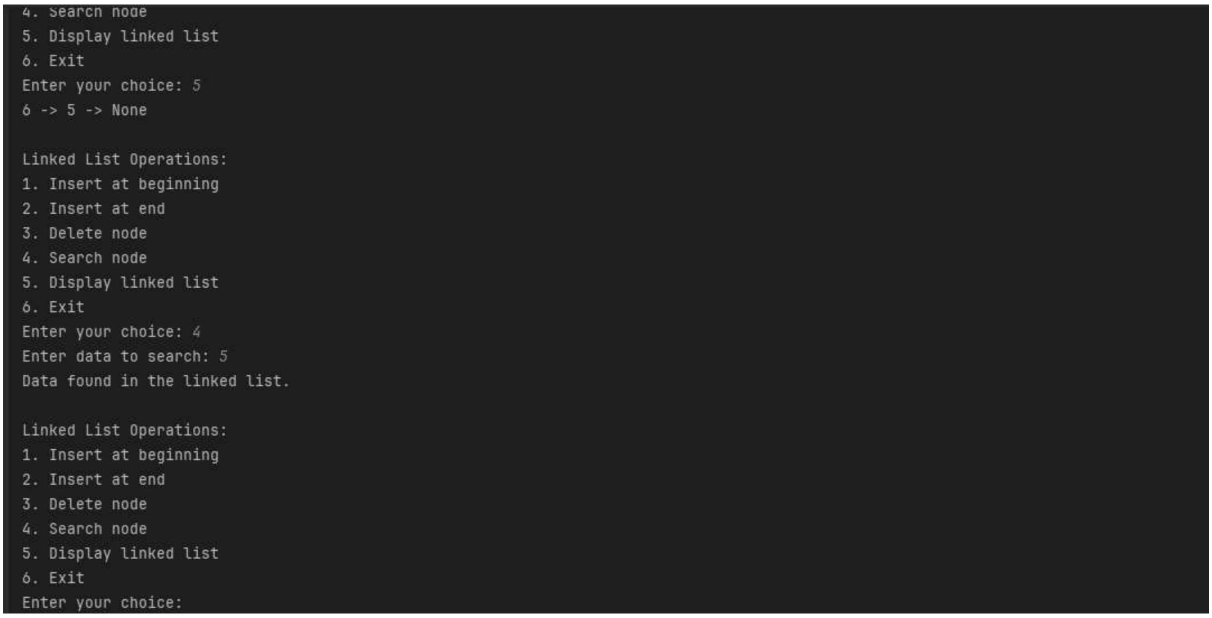
```
C:\Users\anand\PycharmProjects\pythonProject\.venv\Scripts\python.exe C:\Users\anand\PycharmProjects\pythonProject\main.py

Linked List Operations:
1. Insert at beginning
2. Insert at end
3. Delete node
4. Search node
5. Display linked list
6. Exit
Enter your choice: 1
Enter data to insert at beginning: 2

Linked List Operations:
1. Insert at beginning
2. Insert at end
3. Delete node
4. Search node
5. Display linked list
6. Exit
Enter your choice: 2
Enter data to insert at end: 5
```



```
3. Delete node
4. Search node
5. Display linked list
6. Exit
Enter your choice: 5
2 -> 5 -> None

Linked List Operations:
1. Insert at beginning
2. Insert at end
3. Delete node
4. Search node
5. Display linked list
6. Exit
Enter your choice: 1
Enter data to insert at beginning: 6

Linked List Operations:
1. Insert at beginning
2. Insert at end
3. Delete node
4. Search node
5. Display linked list
6. Exit
Enter your choice:
```



```
5. Display linked list
6. Exit
Enter your choice: 1
Enter data to insert at beginning: 6

Linked List Operations:
1. Insert at beginning
2. Insert at end
3. Delete node
4. Search node
5. Display linked list
6. Exit
Enter your choice: 5
6 -> 2 -> 5 -> None

Linked List Operations:
1. Insert at beginning
2. Insert at end
3. Delete node
4. Search node
5. Display linked list
6. Exit
Enter your choice: 3
Enter data to delete: 2
```



```
4. Search node
5. Display linked list
6. Exit
Enter your choice: 5
6 -> 5 -> None

Linked List Operations:
1. Insert at beginning
2. Insert at end
3. Delete node
4. Search node
5. Display linked list
6. Exit
Enter your choice: 4
Enter data to search: 5
Data found in the linked list.

Linked List Operations:
1. Insert at beginning
2. Insert at end
3. Delete node
4. Search node
5. Display linked list
6. Exit
Enter your choice:
```

Conclusion: The exploration of data structures in Python facilitates efficient organization and manipulation of data. By implementing linked lists, stacks, and queues using built-in functions, developers gain practical experience in handling different data structures. Understanding these fundamental concepts enhances problem-solving skills and promotes code readability and scalability. Python's versatile built-in data structures enable developers to build robust and adaptable solutions for a wide range of computational tasks.