Assignment-11.5

Name: G.Dhanush Reddy

Ht.no: 2303A51619

Batch. No: 22

Task Description #1 – Stack Implementation

Prompt:

Create a Python Stack class using a list. Include methods: push, pop, peek and is_empty. Add proper docstrings and it should handle edge cases and errors. Take input from user to demonstrate the functionality of the Stack class.

Code:

```python
class Stack:
    """A simple Stack implementation using a list."""

    def __init__(self):
        """Initialize an empty stack."""
        self.stack = []

    def push(self, item):
        """Add an item to the top of the stack.

        Args:
            item: The item to be added to the stack.
        """
        self.stack.append(item)

    def pop(self):
        """Remove and return the item at the top of the stack.

        Returns:
            The item at the top of the stack.

        Raises:
            IndexError: If the stack is empty.
        """
        if self.is_empty():
            raise IndexError("Pop from an empty stack")
        return self.stack.pop()

    def peek(self):
        """Return the item at the top of the stack without removing it.

        Returns:
            The item at the top of the stack.

        Raises:
            IndexError: If the stack is empty.
        """
        if self.is_empty():
            raise IndexError("Peek from an empty stack")
        return self.stack[-1]

    def is_empty(self):
        """Check if the stack is empty.

        Returns:
            True if the stack is empty, False otherwise.
        """
        return len(self.stack) == 0
# Demonstrate the functionality of the Stack class
if __name__ == "__main__":
    stack = Stack()
    while True:
        action = input("Enter an action (push, pop, peek, is_empty, quit): ").strip().lower()
        if action == "push":
            item = input("Enter an item to push onto the stack: ")
            stack.push(item)
            print(f"'{item}' has been pushed onto the stack.")
        elif action == "pop":
            try:
                item = stack.pop()
                print(f"'{item}' has been popped from the stack.")
            except IndexError as e:
                print(e)
        elif action == "peek":
            try:
                item = stack.peek()
                print(f"The top item on the stack is: '{item}'.")
            except IndexError as e:
                print(e)
        elif action == "is_empty":
            if stack.is_empty():
                print("The stack is empty.")
            else:
                print("The stack is not empty.")
        elif action == "quit":
            print("Exiting the program.")
            break
        else:
            print("Invalid action. Please try again.")
```

Output:

```
ython.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '52968' '--
\OneDrive\3RD Year\AIAC\9.5.py'
Enter an action (push, pop, peek, is_empty, quit): push
Enter an item to push onto the stack: bye
bye has been pushed onto the stack.
Enter an action (push, pop, peek, is_empty, quit): pop
bye has been popped from the stack.
Enter an action (push, pop, peek, is_empty, quit): Hello
Invalid action. Please try again.
Enter an action (push, pop, peek, is_empty, quit): pop
hii has been popped from the stack.
Enter an action (push, pop, peek, is_empty, quit): push
Enter an item to push onto the stack: Hello
Hello has been pushed onto the stack.
Enter an action (push, pop, peek, is_empty, quit): quit
Exiting the program.
PS C:\Users\Dhanush Reddy\OneDrive\3RD Year\AIAC>
```

Observation:

The Stack class works correctly by following the Last In, First Out (LIFO) principle, where the most recently pushed element is removed first. The push, pop, peek, and is_empty methods perform as expected, including proper handling of edge cases like popping or peeking from an empty stack. The interactive user input successfully demonstrates the functionality and error handling of the stack implementation.

Task Description #2 – Queue Implementation

Prompt:

Create a Python Queue class using a list. Implement enqueue, dequeue, peek, and size methods. Follow FIFO principle. Add proper docstrings and handle empty queue errors. Take input from user to demonstrate the functionality of the Queue class.

Code:

```python
class Queue:
    """A simple Queue implementation using a list."""

    def __init__(self):
        """Initialize an empty queue."""
        self.queue = []

    def enqueue(self, item):
        """Add an item to the end of the queue.

        Args:
            item: The item to be added to the queue.
        """
        self.queue.append(item)

    def dequeue(self):
        """Remove and return the item at the front of the queue.

        Returns:
            The item at the front of the queue.

        Raises:
            IndexError: If the queue is empty.
        """
        if self.is_empty():
            raise IndexError("Dequeue from an empty queue")
        return self.queue.pop(0)

    def peek(self):
        """Return the item at the front of the queue without removing it.

        Returns:
            The item at the front of the queue.

        Raises:
            IndexError: If the queue is empty.
        """
        if self.is_empty():
            raise IndexError("Peek from an empty queue")
        return self.queue[0]

    def size(self):
        """Return the number of items in the queue.

        Returns:
            The size of the queue.
        """
        return len(self.queue)

    def is_empty(self):
        """Check if the queue is empty.

        Returns:
            True if the queue is empty, False otherwise.
        """
        return len(self.queue) == 0
# Demonstrate the functionality of the Queue class
if __name__ == "__main__":
    queue = Queue()
    while True:
        action = input("Enter an action (enqueue, dequeue, peek, size, is_empty, quit): ").strip().lower()
        if action == "enqueue":
            item = input("Enter an item to enqueue: ")
            queue.enqueue(item)
            print(f"'{item}' has been enqueued.")
        elif action == "dequeue":
            try:
                item = queue.dequeue()
                print(f"'{item}' has been dequeued.")
            except IndexError as e:
                print(e)
        elif action == "peek":
            try:
                item = queue.peek()
                print(f"The front item in the queue is: '{item}'.")
            except IndexError as e:
                print(e)
        elif action == "size":
            print(f"The size of the queue is: {queue.size()}.")
        elif action == "is_empty":
            if queue.is_empty():
                print("The queue is empty.")
            else:
                print("The queue is not empty.")
        elif action == "quit":
            print("Exiting the program.")
            break
        else:
            print("Invalid action. Please try again.")
```

Output:

```
\OneDrive\3RD Year\AIAC\9.5.py'
Enter an action (enqueue, dequeue, peek, size, is_empty, quit): enqueue
Enter an item to enqueue: 20
20 has been enqueued.
Enter an action (enqueue, dequeue, peek, size, is_empty, quit): enqueue
Enter an item to enqueue: 50
50 has been enqueued.
Enter an action (enqueue, dequeue, peek, size, is_empty, quit): dequeue
20 has been dequeued.
Enter an action (enqueue, dequeue, peek, size, is_empty, quit): peek
The item at the front of the queue is: 50
Enter an action (enqueue, dequeue, peek, size, is_empty, quit): size
The size of the queue is: 1
Enter an action (enqueue, dequeue, peek, size, is_empty, quit): quit
Exiting the program.
PS C:\Users\Dhanush Reddy\OneDrive\3RD Year\AIAC>
```

Observation:

The Queue class correctly follows the First In, First Out (FIFO) principle, ensuring that elements are removed in the same order they were added. All methods including enqueue, dequeue, peek, and size function properly and handle edge cases like empty queue operations. The implementation effectively demonstrates queue behavior using Python lists.

Task Description #3 – Linked List

Prompt:

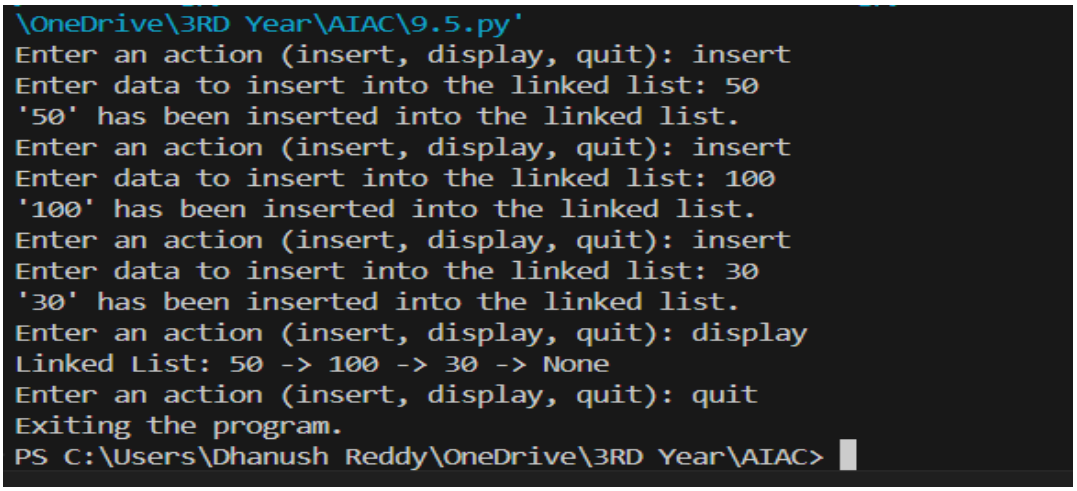
Create a Python implementation of a Singly Linked List. Define a Node class and a LinkedList class.

Include methods: insert(data) to add at the end and display() to print all elements. Add proper docstrings and basic error handling. Take input from user to demonstrate the functionality of the LinkedList class.

Code:

```python
class Node:
    """A Node in a singly linked list."""

    def __init__(self, data):
        """Initialize a node with data and a pointer to the next node."""
        self.data = data
        self.next = None

class LinkedList:
    """A simple implementation of a singly linked list."""

    def __init__(self):
        """Initialize an empty linked list."""
        self.head = None

    def insert(self, data):
        """Insert a new node with the given data at the end of the list.

        Args:
            data: The data to be stored in the new node.
        """
        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 display(self):
        """Print all elements in the linked list."""
        current_node = self.head
        while current_node:
            print(current_node.data, end=" -> ")
            current_node = current_node.next
        print("None")
# Demonstrate the functionality of the LinkedList class
if __name__ == "__main__":
    linked_list = LinkedList()
    while True:
        action = input("Enter an action (insert, display, quit): ").strip().lower()
        if action == "insert":
            data = input("Enter data to insert into the linked list: ")
            linked_list.insert(data)
            print(f"'{data}' has been inserted into the linked list.")
        elif action == "display":
            print("Linked List: ", end="")
            linked_list.display()
        elif action == "quit":
            print("Exiting the program.")
            break
        else:
            print("Invalid action. Please try again.")
```

Output:



Observation:

The Singly Linked List correctly stores elements in sequential order using node connections. The insert method successfully adds elements at the end of the list, and the display method prints all nodes clearly. The implementation also handles the empty list case properly without errors.

Task Description #4 – Hash Table

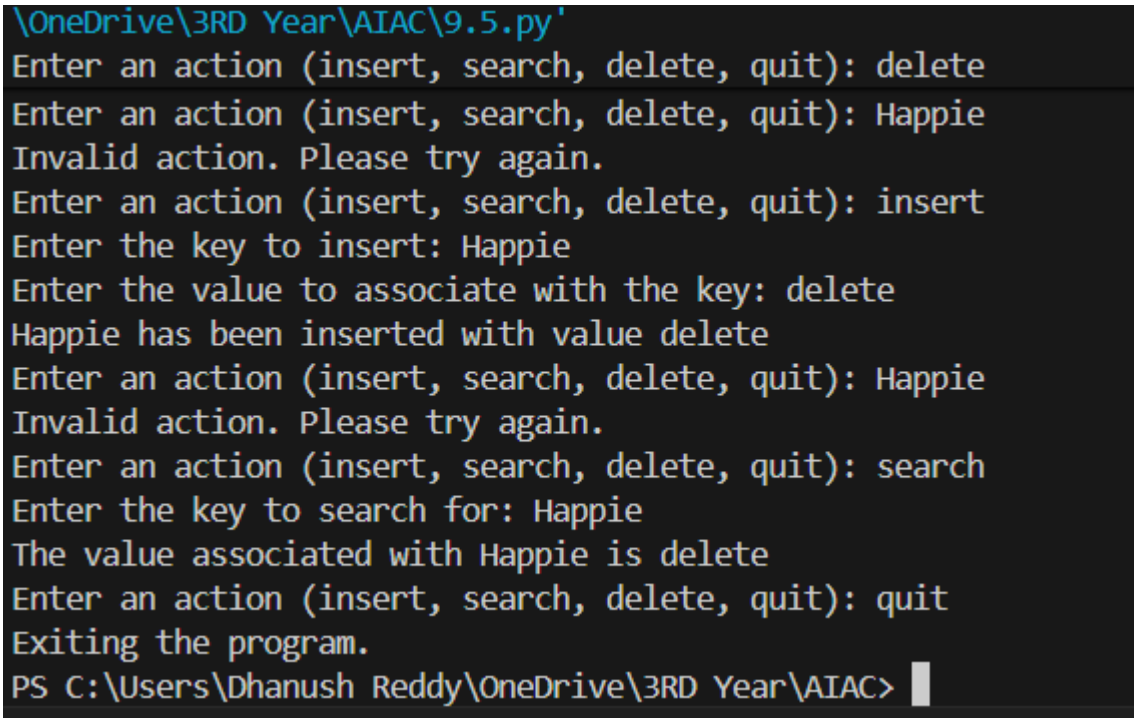
Prompt:

Create a Python HashTable class. Implement insert, search, and delete methods. Add proper docstrings and basic error handling. Take input from user to demonstrate the functionality of the HashTable class.

Code:

```python
class HashTable:
    """A simple HashTable implementation using a list of buckets."""

    def __init__(self, size=10):
        """Initialize the hash table with a specified size."""
        self.size = size
        self.table = [[] for _ in range(size)]

    def _hash(self, key):
        """Generate a hash for the given key."""
        return hash(key) % self.size

    def insert(self, key, value):
        """Insert a key-value pair into the hash table.

        Args:
            key: The key to be inserted.
            value: The value associated with the key.
        """
        index = self._hash(key)
        bucket = self.table[index]
        for i, (k, v) in enumerate(bucket):
            if k == key:
                bucket[i] = (key, value)  # Update existing key
                return
        bucket.append((key, value))  # Insert new key-value pair

    def search(self, key):
        """Search for a value by its key.

        Args:
            key: The key to search for.

        Returns:
            The value associated with the key if found, else None.
        """
        index = self._hash(key)
        bucket = self.table[index]
        for k, v in bucket:
            if k == key:
                return v
        return None

    def delete(self, key):
        """Delete a key-value pair from the hash table.

        Args:
            key: The key to be deleted.

        Raises:
            KeyError: If the key is not found in the hash table.
        """
        index = self._hash(key)
        bucket = self.table[index]
        for i, (k, v) in enumerate(bucket):
            if k == key:
                del bucket[i]
                return
        raise KeyError(f"Key '{key}' not found in the hash table.")
# Demonstrate the functionality of the HashTable class
if __name__ == "__main__":
    hash_table = HashTable()
    while True:
        action = input("Enter an action (insert, search, delete, quit): ").strip().lower()
        if action == "insert":
            key = input("Enter the key to insert: ")
            value = input("Enter the value to associate with the key: ")
            hash_table.insert(key, value)
            print(f"'{key}' has been inserted with value '{value}'.")
        elif action == "search":
            key = input("Enter the key to search for: ")
            value = hash_table.search(key)
            if value is not None:
                print(f"The value associated with '{key}' is '{value}'.")
            else:
                print(f"'{key}' not found in the hash table.")
        elif action == "delete":
            key = input("Enter the key to delete: ")
            try:
                hash_table.delete(key)
                print(f"'{key}' has been deleted from the hash table.")
            except KeyError as e:
                print(e)
        elif action == "quit":
            print("Exiting the program.")
            break
        else:
            print("Invalid action. Please try again.")
```

Output:



Observation:

The hash table correctly stores and retrieves key-value pairs using a hash function and chaining for collision handling. The insert, search, and delete operations work efficiently even when multiple keys map to the same index. Edge cases such as deleting or searching for non-existing keys are handled properly without crashing the program.

Task Description #5 – Graph Representation

Prompt:

Create a Graph class using an adjacency list (dictionary).

Include methods: add_vertex, add_edge, and display. Add proper docstrings and basic error handling. Take input from user to demonstrate the functionality of the Graph class.

Code:

```python
class Graph:
    """A simple Graph implementation using an adjacency list."""

    def __init__(self):
        """Initialize an empty graph."""
        self.graph = {}

    def add_vertex(self, vertex):
        """Add a vertex to the graph.

        Args:
            vertex: The vertex to be added.
        """
        if vertex not in self.graph:
            self.graph[vertex] = []

    def add_edge(self, vertex1, vertex2):
        """Add an edge between two vertices in the graph.

        Args:
            vertex1: The first vertex.
            vertex2: The second vertex.

        Raises:
            ValueError: If either vertex is not in the graph.
        """
        if vertex1 not in self.graph or vertex2 not in self.graph:
            raise ValueError("Both vertices must be in the graph")
        self.graph[vertex1].append(vertex2)
        self.graph[vertex2].append(vertex1)  # For undirected graph

    def display(self):
        """Display the graph as an adjacency list."""
        for vertex, edges in self.graph.items():
            print(f"{vertex}: {', '.join(edges)}")
# Demonstrate the functionality of the Graph class
if __name__ == "__main__":
    graph = Graph()
    while True:
        action = input("Enter an action (add_vertex, add_edge, display, quit): ").strip().lower()
        if action == "add_vertex":
            vertex = input("Enter the vertex to add: ")
            graph.add_vertex(vertex)
            print(f"'{vertex}' has been added to the graph.")
        elif action == "add_edge":
            vertex1 = input("Enter the first vertex: ")
            vertex2 = input("Enter the second vertex: ")
            try:
                graph.add_edge(vertex1, vertex2)
                print(f"An edge has been added between '{vertex1}' and '{vertex2}'.")
            except ValueError as e:
                print(e)
        elif action == "display":
            print("Graph adjacency list:")
            graph.display()
        elif action == "quit":
            print("Exiting the program.")
            break
        else:
            print("Invalid action. Please try again.")
```

Output:

```
OneDrive\3RD Year\AIAC\9.5.py'
Enter an action (add_vertex, add_edge, display, quit): add_vertex
Enter the vertex to add: me
me has been added to the graph.
Enter an action (add_vertex, add_edge, display, quit): add_vertex
Enter the vertex to add: hi
hi has been added to the graph.
Enter an action (add_vertex, add_edge, display, quit): add_edge
Enter the first vertex: 4
Enter the second vertex: B
Both vertices must be in the graph
Enter an action (add_vertex, add_edge, display, quit): add_edge
Enter the first vertex: me
Enter the second vertex: hi
An edge has been added between me and hi.
Enter an action (add_vertex, add_edge, display, quit): display
Graph adjacency list:
me: hi
hi: me
Enter an action (add_vertex, add_edge, display, quit): quit
Exiting the program.
PS C:\Users\Dhanush Reddy\OneDrive\3RD Year\AIAC>
```

Observation:

The graph implementation correctly stores vertices and edges using an adjacency list structure. The add_vertex and add_edge methods properly update connections between nodes in an undirected manner. The display method successfully shows all vertices along with their connected neighbors, confirming correct functionality.

Task Description #6: Smart Hospital Management System – Data Structure Selection

Prompt:

Create a Python program for Smart Hospital Management System. Implement Emergency Case Handling using a Priority Queue. Patients with higher priority (critical level) should be treated first. Include functions to add patient, treat patient, and display waiting list. Add proper docstrings, and basic error handling. Take input from user to demonstrate the functionality of the Smart Hospital Management System.

Code:

```python
import heapq
class Patient:
    """A class representing a patient in the hospital."""

    def __init__(self, name, priority):
        """Initialize a patient with a name and priority level."""
        self.name = name
        self.priority = priority

    def __lt__(self, other):
        """Define less than for comparison based on priority."""
        return self.priority < other.priority
class SmartHospitalManagementSystem:
    """A Smart Hospital Management System using a priority queue for emergency case handling."""

    def __init__(self):
        """Initialize an empty priority queue for patients."""
        self.waiting_list = []

    def add_patient(self, name, priority):
        """Add a patient to the waiting list with a given priority.

        Args:
            name: The name of the patient.
            priority: The priority level of the patient (lower number means higher priority).
        """
        patient = Patient(name, priority)
        heapq.heappush(self.waiting_list, patient)

    def treat_patient(self):
        """Treat the patient with the highest priority (lowest number).

        Returns:
            The name of the treated patient.

        Raises:
            IndexError: If there are no patients in the waiting list.
        """
        if not self.waiting_list:
            raise IndexError("No patients to treat")
        patient = heapq.heappop(self.waiting_list)
        return patient.name

    def display_waiting_list(self):
        """Display the waiting list of patients sorted by priority."""
        sorted_patients = sorted(self.waiting_list)
        print("Waiting List:")
        for patient in sorted_patients:
            print(f"Patient Name: {patient.name}, Priority: {patient.priority}")
# Demonstrate the functionality of the Smart Hospital Management System
if __name__ == "__main__":
    hospital_system = SmartHospitalManagementSystem()
    while True:
        action = input("Enter an action (add_patient, treat_patient, display_waiting_list, quit): ").strip().lower()
        if action == "add_patient":
            name = input("Enter the patient's name: ")
            try:
                priority = int(input("Enter the patient's priority (lower number means higher priority): "))
                hospital_system.add_patient(name, priority)
                print(f"Patient '{name}' with priority {priority} has been added to the waiting list.")
            except ValueError:
                print("Invalid priority. Please enter a number.")
        elif action == "treat_patient":
            try:
                treated_patient = hospital_system.treat_patient()
                print(f"Patient '{treated_patient}' has been treated.")
            except IndexError as e:
                print(e)
        elif action == "display_waiting_list":
            hospital_system.display_waiting_list()
        elif action == "quit":
            print("Exiting the program.")
            break
        else:
            print("Invalid action. Please try again.")
```

Output:

```
\OneDrive\3RD Year\AIAC\9.5.py'
Enter an action (add_patient, treat_patient, display_waiting_list, quit): add_patient
Enter the patient's name: Dhanush
Enter the patient's priority (lower number means higher priority): 4
Patient Dhanush with priority 4 has been added to the waiting list.
Enter an action (add_patient, treat_patient, display_waiting_list, quit): Lokesh
Invalid action. Please try again.
Enter an action (add_patient, treat_patient, display_waiting_list, quit): 0
Invalid action. Please try again.
Enter an action (add_patient, treat_patient, display_waiting_list, quit): 1
Invalid action. Please try again.
Enter an action (add_patient, treat_patient, display_waiting_list, quit): treat_patient
Patient Dhanush has been treated.
Enter an action (add_patient, treat_patient, display_waiting_list, quit): display_waiting_list
Waiting list:
Enter an action (add_patient, treat_patient, display_waiting_list, quit): quit
Exiting the program.
PS C:\Users\Dhanush Reddy\OneDrive\3RD Year\AIAC>
```

Observation:

The Priority Queue ensures that patients are treated based on the severity of their condition rather than their arrival time. Patients with critical conditions are given higher priority and attended to first, which supports effective emergency management. The system also properly handles situations when no patients are waiting and maintains efficient performance during patient insertion and treatment.

Task Description #7: Smart City Traffic Control System

Prompt:

Create a Smart Traffic Emergency Vehicle System using Priority Queue. Vehicles have name and priority (1 = highest). Implement add_vehicle(), serve_vehicle(), and display_queue(). Include docstrings and basic error handling. Take input from user to demonstrate the functionality of the Smart Traffic Emergency Vehicle System.

Code:

```python
import heapq
class Vehicle:
    """A class representing an emergency vehicle."""

    def __init__(self, name, priority):
        """Initialize a vehicle with a name and priority level."""
        self.name = name
        self.priority = priority

    def __lt__(self, other):
        """Define less than for comparison based on priority."""
        return self.priority < other.priority
class SmartTrafficEmergencyVehicleSystem:
    """A Smart Traffic Emergency Vehicle System using a priority queue."""

    def __init__(self):
        """Initialize an empty priority queue for vehicles."""
        self.vehicle_queue = []

    def add_vehicle(self, name, priority):
        """Add a vehicle to the queue with a given priority.

        Args:
            name: The name of the vehicle.
            priority: The priority level of the vehicle (lower number means higher priority).
        """
        vehicle = Vehicle(name, priority)
        heapq.heappush(self.vehicle_queue, vehicle)

    def serve_vehicle(self):
        """Serve the vehicle with the highest priority (lowest number).

        Returns:
            The name of the served vehicle.

        Raises:
            IndexError: If there are no vehicles in the queue.
        """
        if not self.vehicle_queue:
            raise IndexError("No vehicles to serve")
        vehicle = heapq.heappop(self.vehicle_queue)
        return vehicle.name

    def display_queue(self):
        """Display the queue of vehicles sorted by priority."""
        sorted_vehicles = sorted(self.vehicle_queue)
        print("Vehicle Queue:")
        for vehicle in sorted_vehicles:
            print(f"Vehicle Name: {vehicle.name}, Priority: {vehicle.priority}")
# Demonstrate the functionality of the Smart Traffic Emergency Vehicle System
if __name__ == "__main__":
    traffic_system = SmartTrafficEmergencyVehicleSystem()
    while True:
        action = input("Enter an action (add_vehicle, serve_vehicle, display_queue, quit): ").strip().lower()
        if action == "add_vehicle":
            name = input("Enter the vehicle's name: ")
            try:
                priority = int(input("Enter the vehicle's priority (lower number means higher priority): "))
                traffic_system.add_vehicle(name, priority)
                print(f"Vehicle '{name}' with priority {priority} has been added to the queue.")
            except ValueError:
                print("Invalid priority. Please enter a number.")
        elif action == "serve_vehicle":
            try:
                served_vehicle = traffic_system.serve_vehicle()
                print(f"Vehicle '{served_vehicle}' has been served.")
            except IndexError as e:
                print(e)
        elif action == "display_queue":
            traffic_system.display_queue()
        elif action == "quit":
            print("Exiting the program.")
            break
        else:
            print("Invalid action. Please try again.")
```

Output:

```
\OneDrive\3RD Year\AIAC\9.5.py'
Enter an action (add_vehicle, serve_vehicle, display_queue, quit): add_vehicle
Enter the vehicle's name: Porshe
Enter the vehicle's priority (lower number means higher priority): 1
Vehicle 'Porshe' with priority 1 has been added to the queue.
Enter an action (add_vehicle, serve_vehicle, display_queue, quit): add_vehicle
Enter the vehicle's name: Lamborgini
Enter the vehicle's priority (lower number means higher priority): 2
Vehicle 'Lamborgini' with priority 2 has been added to the queue.
Enter an action (add_vehicle, serve_vehicle, display_queue, quit): serve_vehicle
Vehicle 'Porshe' has been served.
Enter an action (add_vehicle, serve_vehicle, display_queue, quit): add_vehicle
Enter the vehicle's name: Mustang
Enter the vehicle's priority (lower number means higher priority): 1
Vehicle 'Mustang' with priority 1 has been added to the queue.
Enter an action (add_vehicle, serve_vehicle, display_queue, quit): display_queue
Vehicle Queue:
Vehicle Name: Mustang, Priority: 1
Vehicle Name: Lamborgini, Priority: 2
Enter an action (add_vehicle, serve_vehicle, display_queue, quit): quit
Exiting the program.
PS C:\Users\Dhanush Reddy\OneDrive\3RD Year\AIAC>
```

Observation:

The Priority Queue ensures that emergency vehicles such as ambulances and fire trucks are served before normal vehicles regardless of arrival order. This structure was chosen because traffic management requires priority-based handling rather than simple FIFO processing. The implementation successfully demonstrates efficient insertion and removal based on priority levels.

Task Description #8: Smart E-Commerce Platform – Data Structure Challenge

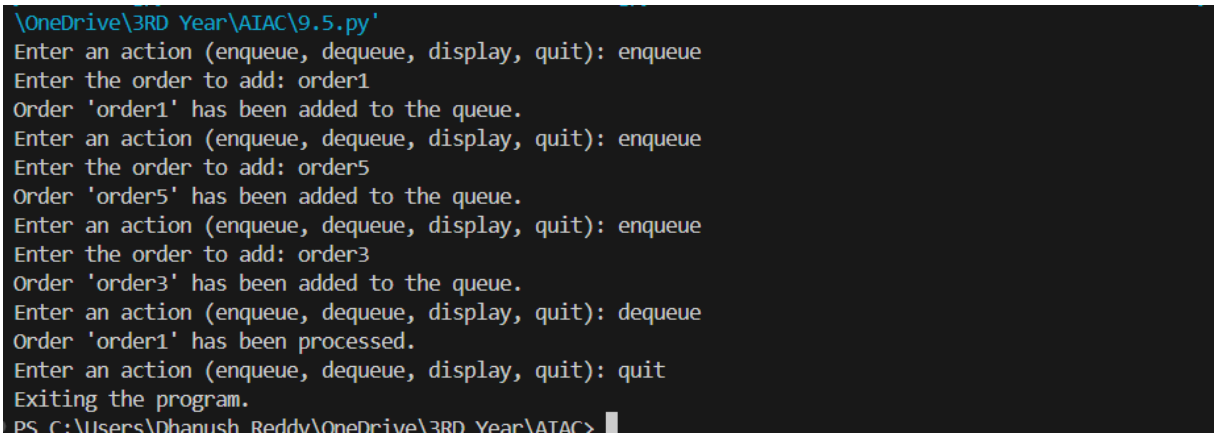
Prompt:

Create a Python program implementing an Order Processing System using a Queue. Include enqueue (add order), dequeue (process order), and display methods. Add proper docstrings, and basic error handling. Take input from user to demonstrate the functionality of the Order Processing System.

Code:

```python
from collections import deque
class OrderProcessingSystem:
    """A simple Order Processing System using a queue."""

    def __init__(self):
        """Initialize an empty queue for orders."""
        self.order_queue = deque()

    def enqueue(self, order):
        """Add an order to the end of the queue.

        Args:
            order: The order to be added to the queue.
        """
        self.order_queue.append(order)

    def dequeue(self):
        """Process and remove the order at the front of the queue.

        Returns:
            The order that was processed.

        Raises:
            IndexError: If there are no orders to process.
        """
        if not self.order_queue:
            raise IndexError("No orders to process")
        return self.order_queue.popleft()

    def display(self):
        """Display all orders in the queue."""
        if not self.order_queue:
            print("No orders in the queue.")
            return
        print("Order Queue:")
        for order in self.order_queue:
            print(order)
# Demonstrate the functionality of the Order Processing System
if __name__ == "__main__":
    order_system = OrderProcessingSystem()
    while True:
        action = input("Enter an action (enqueue, dequeue, display, quit): ").strip().lower()
        if action == "enqueue":
            order = input("Enter the order to add: ")
            order_system.enqueue(order)
            print(f"Order '{order}' has been added to the queue.")
        elif action == "dequeue":
            try:
                processed_order = order_system.dequeue()
                print(f"Order '{processed_order}' has been processed.")
            except IndexError as e:
                print(e)
        elif action == "display":
            order_system.display()
        elif action == "quit":
            print("Exiting the program.")
            break
        else:
            print("Invalid action. Please try again.")
```

Output:



Observation:

The Order Processing System correctly follows the FIFO principle, ensuring fairness in handling customer orders. The Queue data structure was chosen because it processes elements in the exact order they are inserted. This makes it the most suitable and logical structure for managing sequential order execution in an e-commerce system.