ASSIGNMENT-11.1

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Batch - 43

Data Structures with AI: Implementing Fundamental Structures

Task Description #1 – Stack Implementation

Task: Use AI to generate a Stack class with push, pop, peek, and is_empty methods.

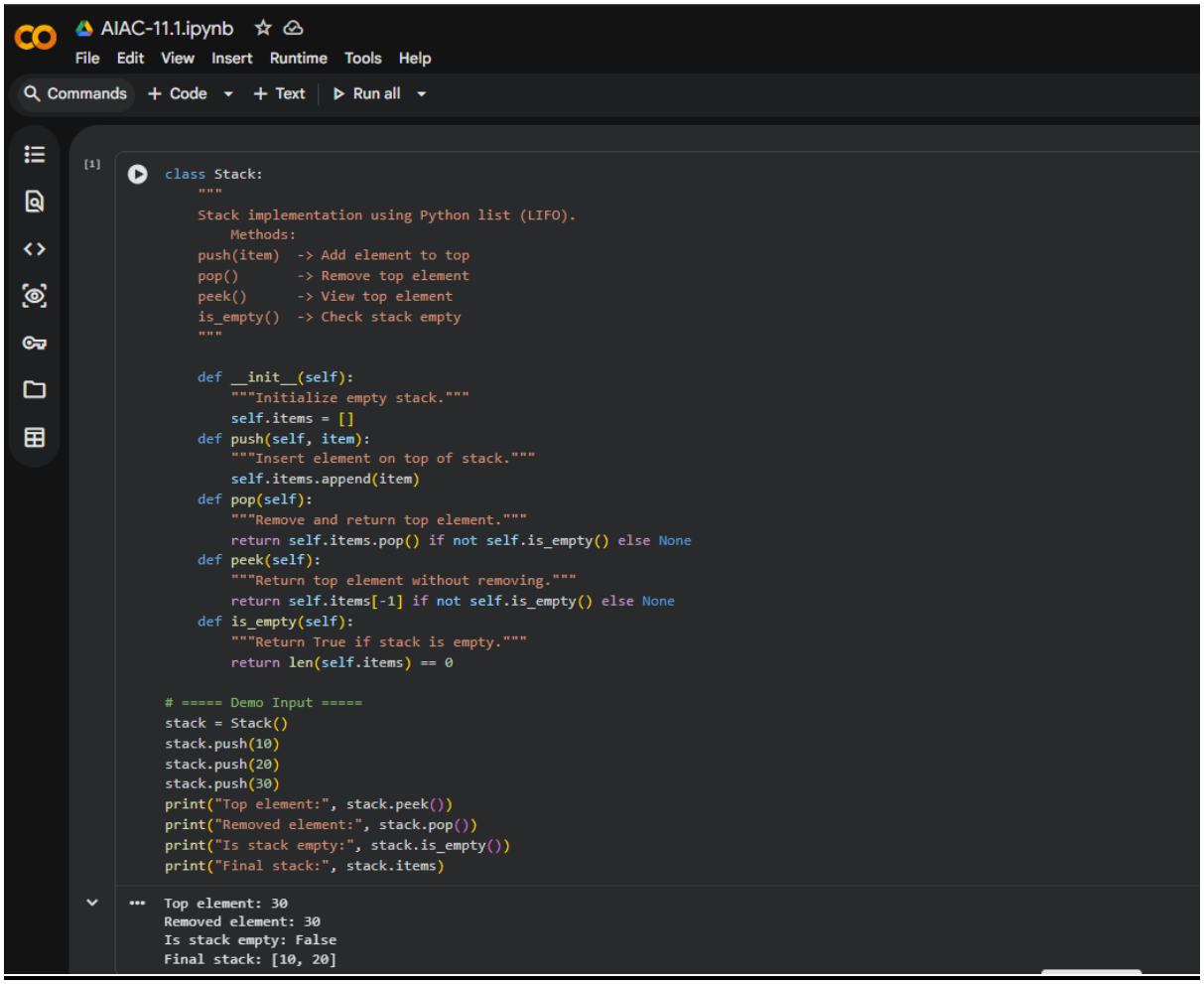
Sample Input Code:

class Stack:

pass

Expected Output:

• A functional stack implementation with all required methods and docstrings.



Task Description #2 – Queue Implementation

Task: Use AI to implement a Queue using Python lists.

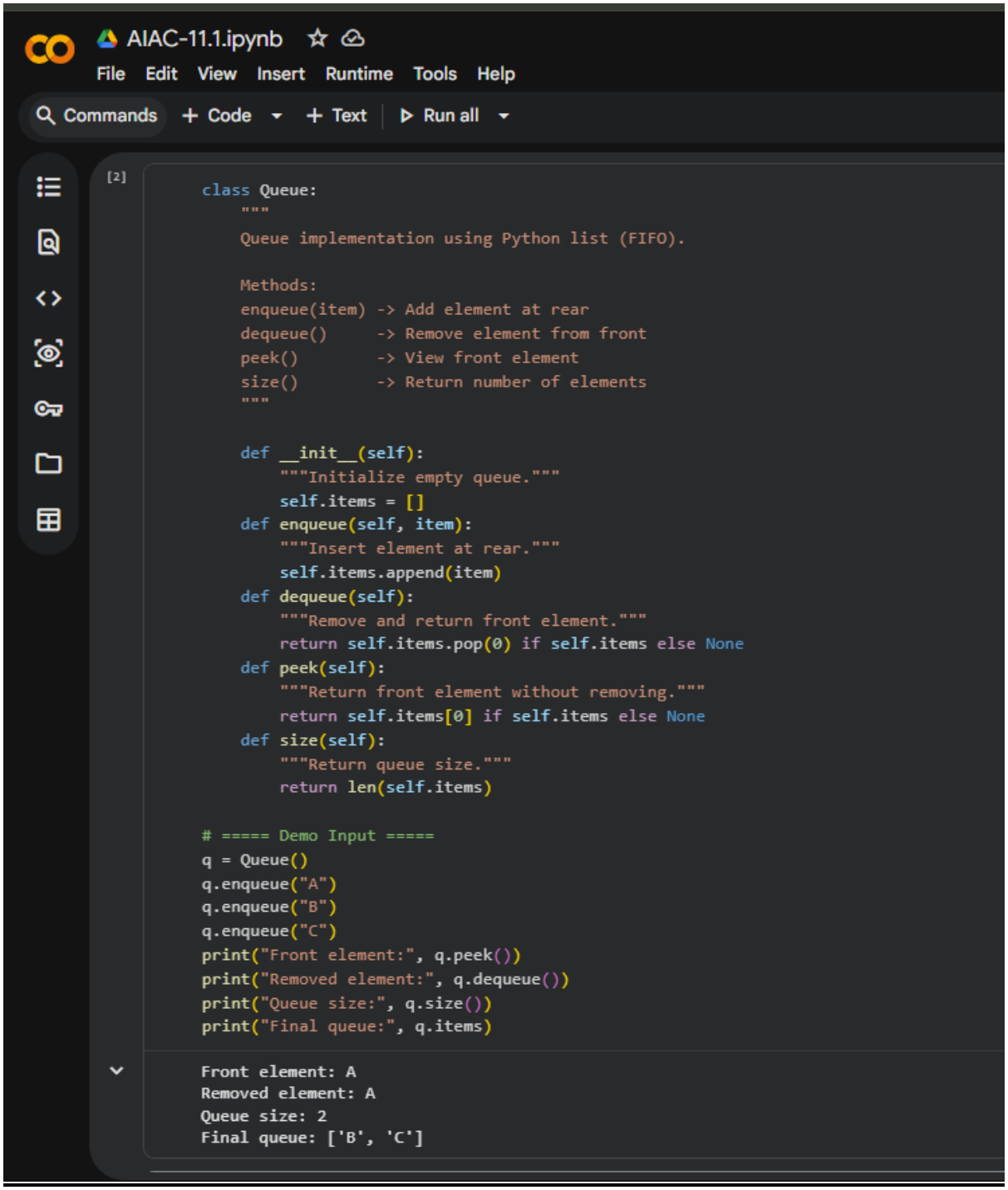
Sample Input Code:

class Queue:

pass

Expected Output:

• FIFO-based queue class with enqueue, dequeue, peek, and size methods.



Task Description #3 – Linked List

Task: Use AI to generate a Singly Linked List with insert and display methods.

Sample Input Code:

class Node:

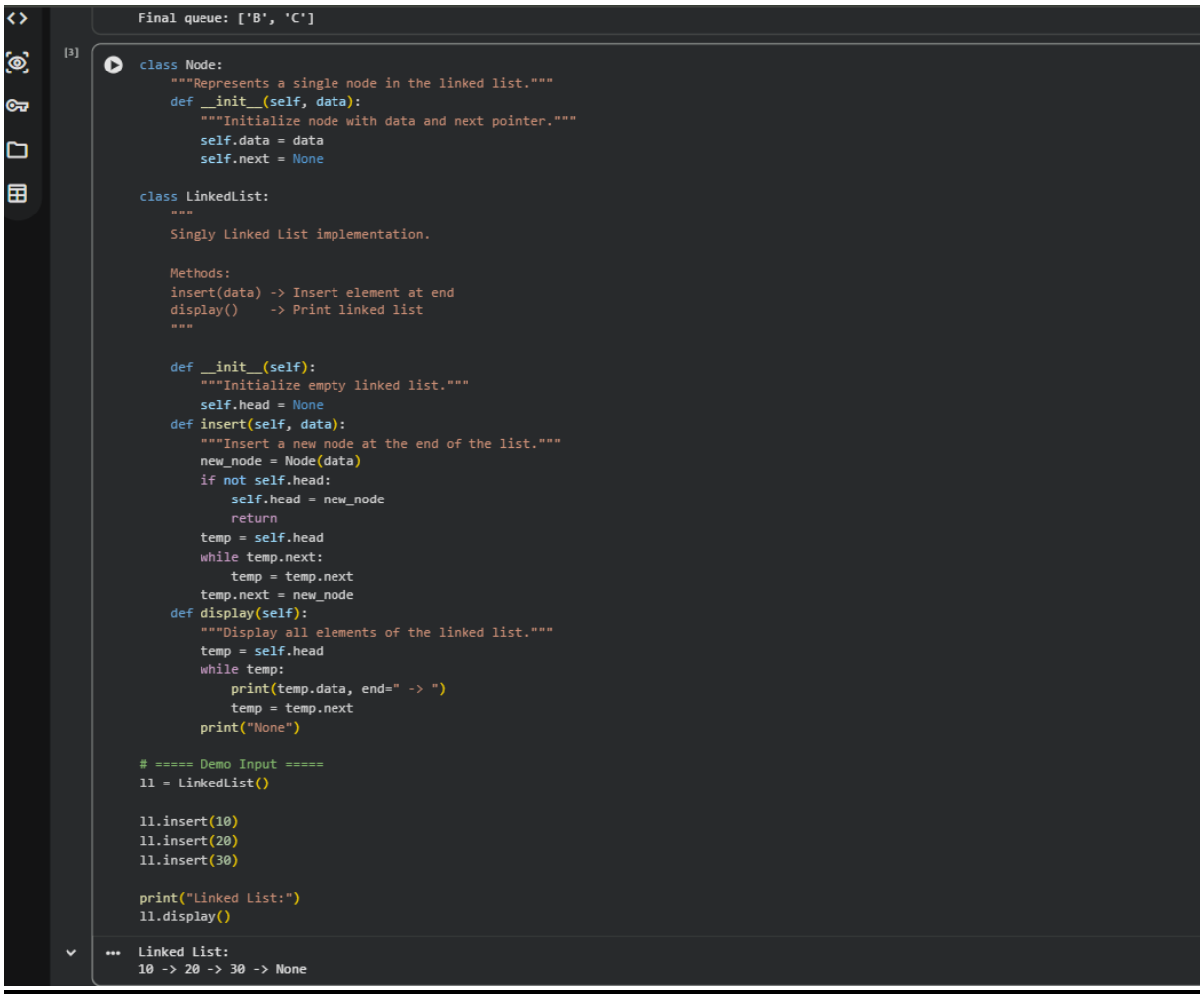
pass

class LinkedList:

pass

Expected Output:

• A working linked list implementation with clear method documentation.



```
Final queue: ['B', 'C']
```

```
[3]
class Node:
    """Represents a single node in the linked list."""
    def __init__(self, data):
        """Initialize node with data and next pointer."""
        self.data = data
        self.next = None

class LinkedList:
    """
    Singly Linked List implementation.

    Methods:
    insert(data) -> Insert element at end
    display()    -> Print linked list
    """

    def __init__(self):
        """Initialize empty linked list."""
        self.head = None
    def insert(self, data):
        """Insert a new node at the end of the list."""
        new_node = Node(data)
        if not self.head:
            self.head = new_node
            return
        temp = self.head
        while temp.next:
            temp = temp.next
        temp.next = new_node
    def display(self):
        """Display all elements of the linked list."""
        temp = self.head
        while temp:
            print(temp.data, end=" -> ")
            temp = temp.next
        print("None")

# ===== Demo Input =====
ll = LinkedList()

ll.insert(10)
ll.insert(20)
ll.insert(30)

print("Linked List:")
ll.display()
```

```
Linked List:
10 -> 20 -> 30 -> None
```

Task Description #4 – Binary Search Tree (BST)

Task: Use AI to create a BST with insert and in-order traversal methods.

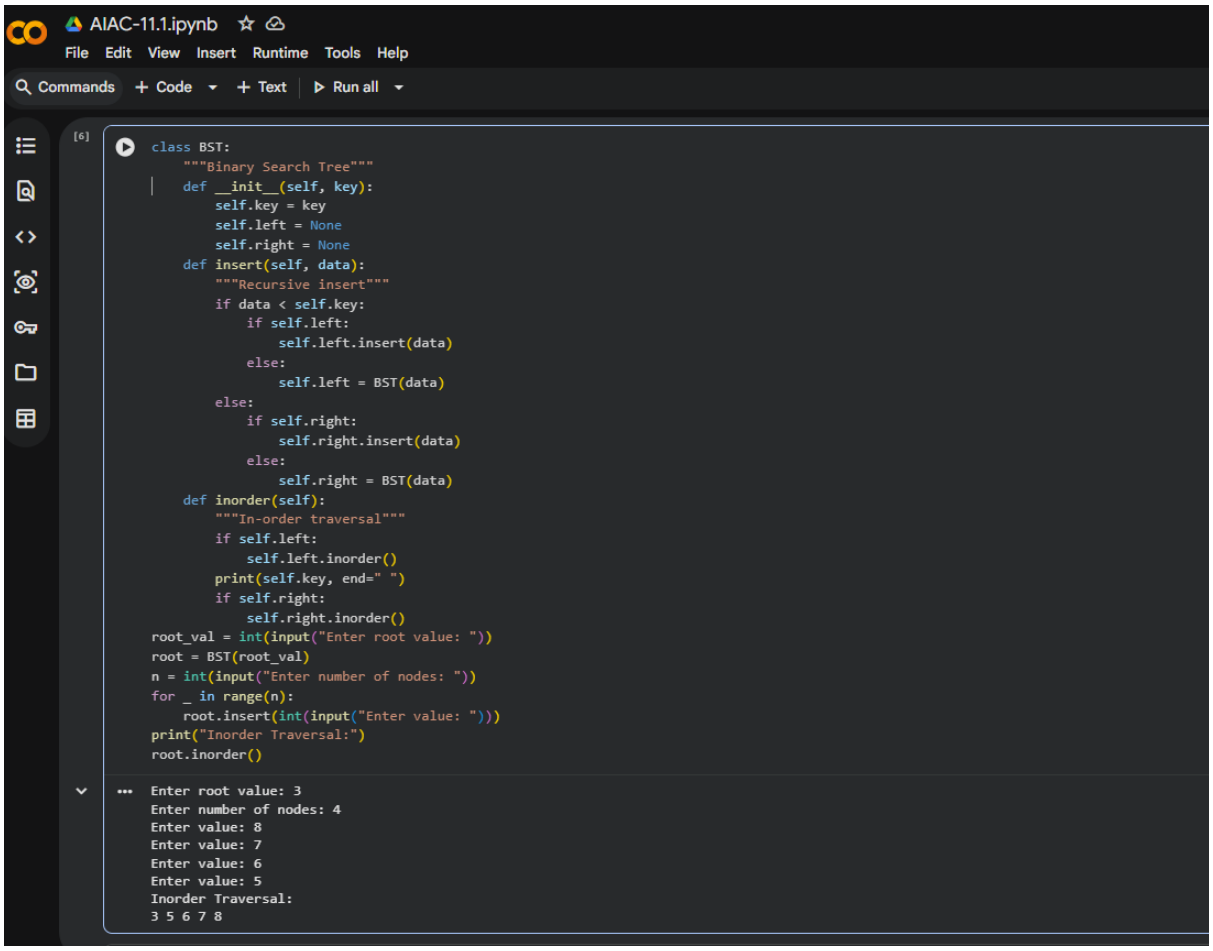
Sample Input Code:

class BST:

pass

Expected Output:

• BST implementation with recursive insert and traversal methods



Task Description #5 – Hash Table

Task: Use AI to implement a hash table with basic insert, search, and delete methods.

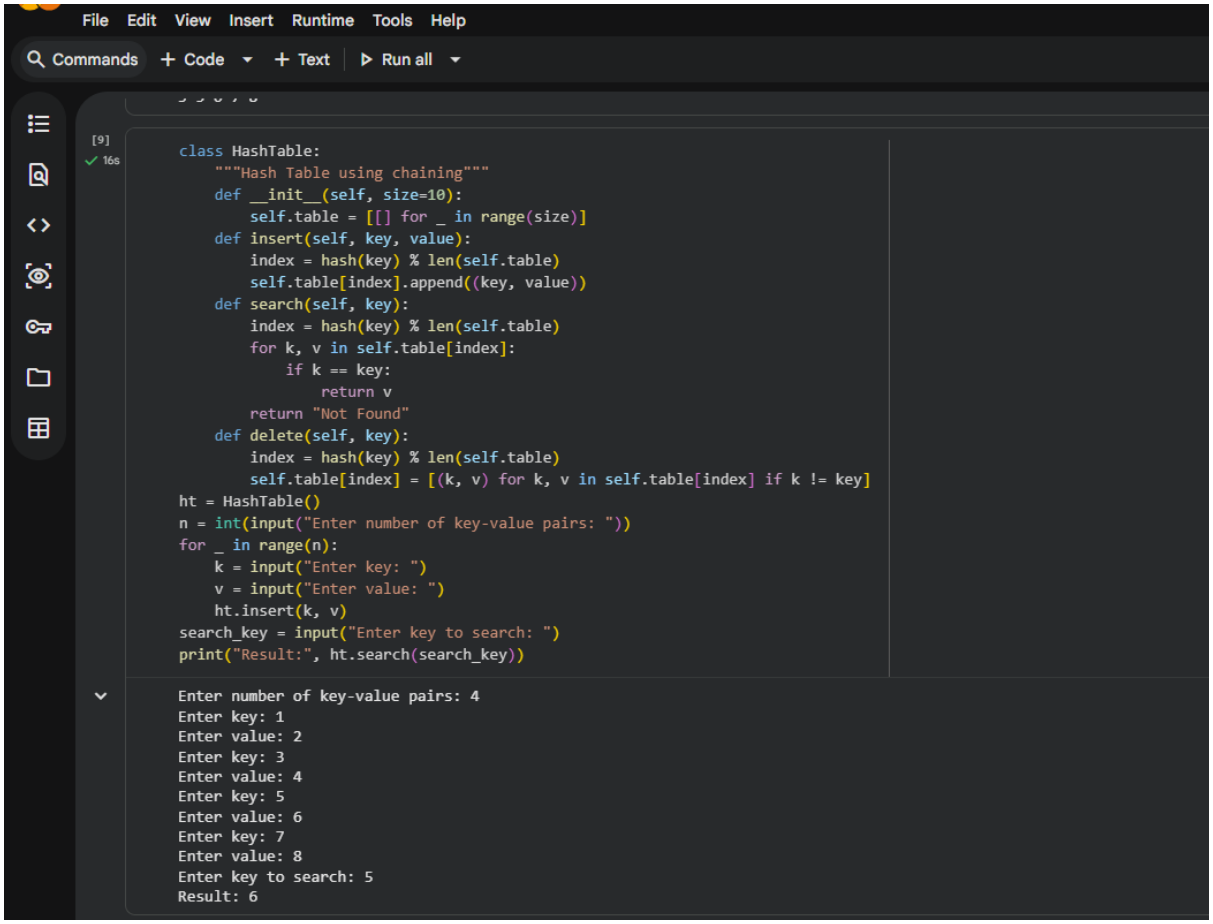
Sample Input Code:

class Hash Table:

pass

Expected Output:

• Collision handling using chaining, with well-commented methods.



Task Description #6 – Graph Representation

Task: Use AI to implement a graph using an adjacency list.

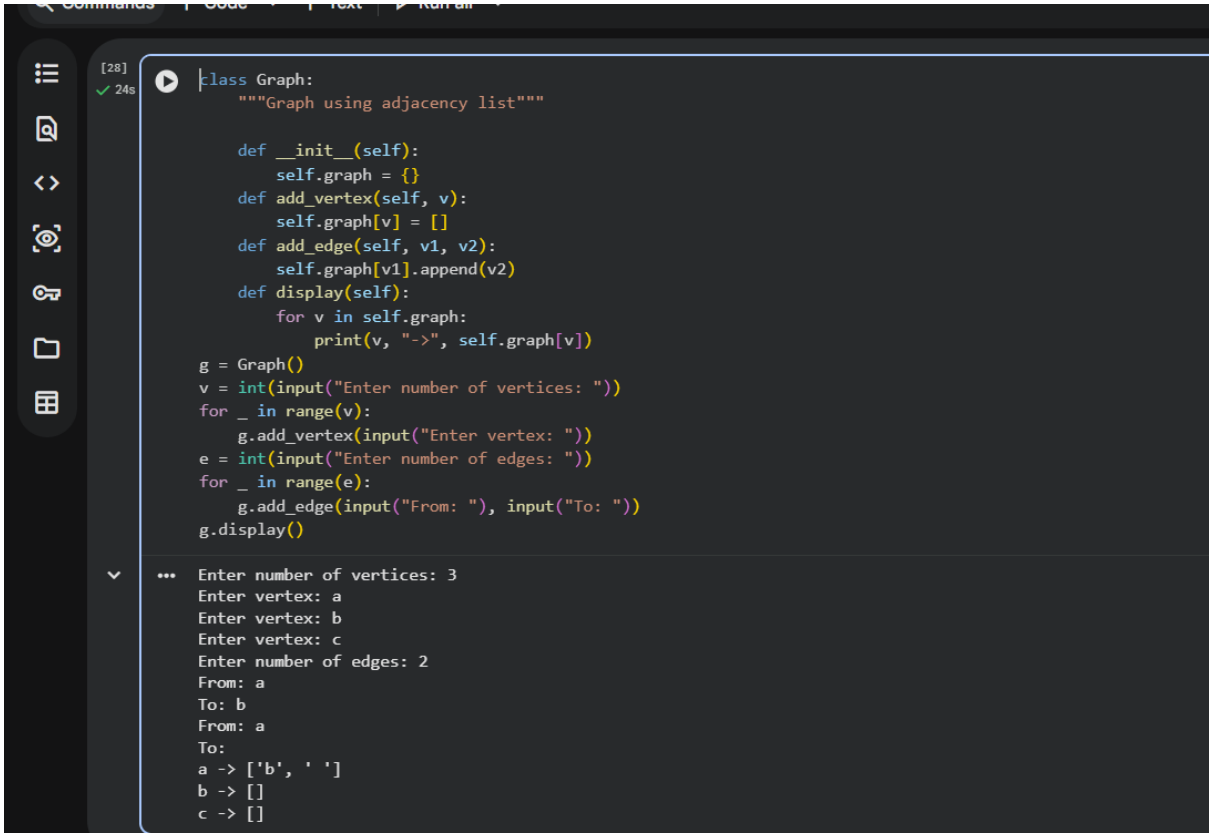
Sample Input Code:

class Graph:

pass

Expected Output:

• Graph with methods to add vertices, add edges, and display connections.



```
[28]
24s
class Graph:
    """Graph using adjacency list"""

    def __init__(self):
        self.graph = {}
    def add_vertex(self, v):
        self.graph[v] = []
    def add_edge(self, v1, v2):
        self.graph[v1].append(v2)
    def display(self):
        for v in self.graph:
            print(v, "->", self.graph[v])
g = Graph()
v = int(input("Enter number of vertices: "))
for _ in range(v):
    g.add_vertex(input("Enter vertex: "))
e = int(input("Enter number of edges: "))
for _ in range(e):
    g.add_edge(input("From: "), input("To: "))
g.display()
```

```
Enter number of vertices: 3
Enter vertex: a
Enter vertex: b
Enter vertex: c
Enter number of edges: 2
From: a
To: b
From: a
To:
a -> ['b', ' ']
b -> []
c -> []
```

Task Description #7 – Priority Queue

Task: Use AI to implement a priority queue using Python's heap q module.

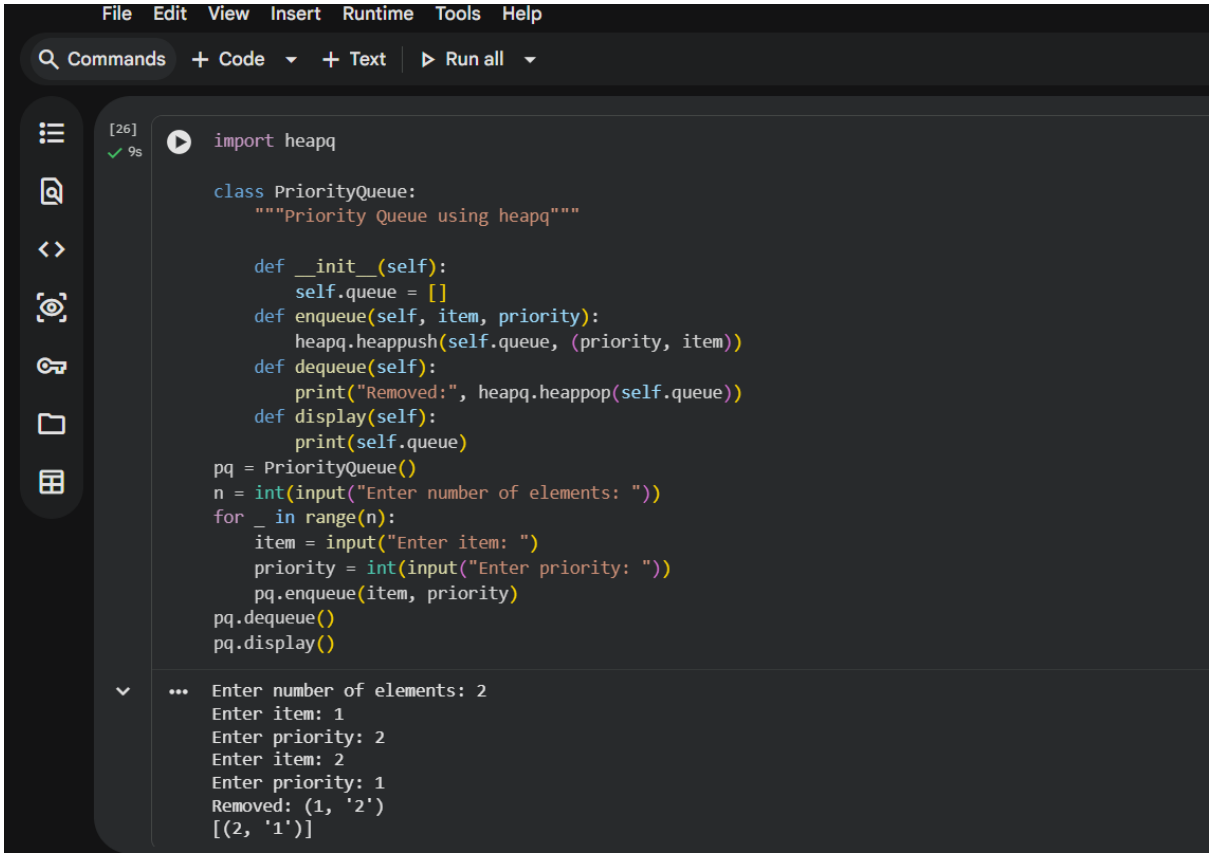
Sample Input Code:

class Priority Queue:

pass

Expected Output:

• Implementation with enqueue (priority), dequeue (highest priority), and display methods.



Task Description #8 – Deque

Task: Use AI to implement a double-ended queue using collections. deque.

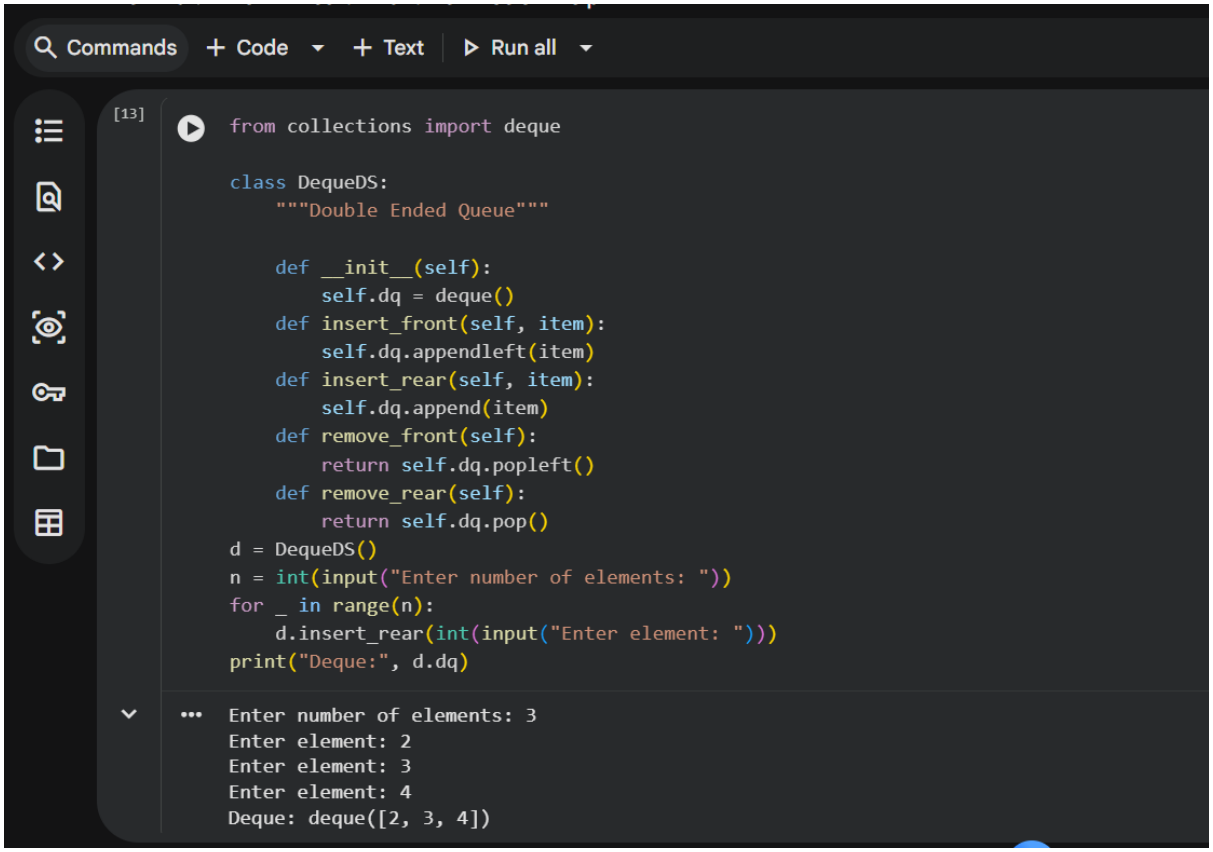
Sample Input Code:

class Deque DS:

pass

Expected Output:

• Insert and remove from both ends with docstrings.



Task Description #9 Real-Time Application Challenge – Choose the Right Data Structure

Scenario:

Your college wants to develop a Campus Resource Management System that handles:

1. Student Attendance Tracking – Daily log of students entering/exiting the campus.

2. Event Registration System – Manage participants in events with quick search and removal.

3. Library Book Borrowing – Keep track of available books and their due dates.

4. Bus Scheduling System – Maintain bus routes and stop connections.

5. Cafeteria Order Queue – Serve students in the order they arrive.

Student Task:

• For each feature, select the most appropriate data structure from the list below:

o Stack

o Queue

o Priority Queue

o Linked List

o Binary Search Tree (BST)

o Graph

o Hash Table

o Deque

• Justify your choice in 2–3 sentences per feature.

• Implement one selected feature as a working Python program with AI-assisted code generation.

Expected Output:

• A table mapping feature → chosen data structure → justification.

• A functional Python program implementing the chosen feature with comments and docstrings.

Task Description #10: Smart E-Commerce Platform – Data Structure Challenge

An e-commerce company wants to build a Smart Online Shopping System

with:

1. Shopping Cart Management – Add and remove products dynamically.

2. Order Processing System – Orders processed in the order they are placed.

3. Top-Selling Products Tracker – Products ranked by sales count.

4. Product Search Engine – Fast lookup of products using product ID.

5. Delivery Route Planning – Connect warehouses and delivery locations.

Student Task:

• For each feature, select the most appropriate data structure from

the list below:

o Stack

o Queue

o Priority Queue

o Linked List

o Binary Search Tree (BST)

o Graph

o Hash Table

o Deque

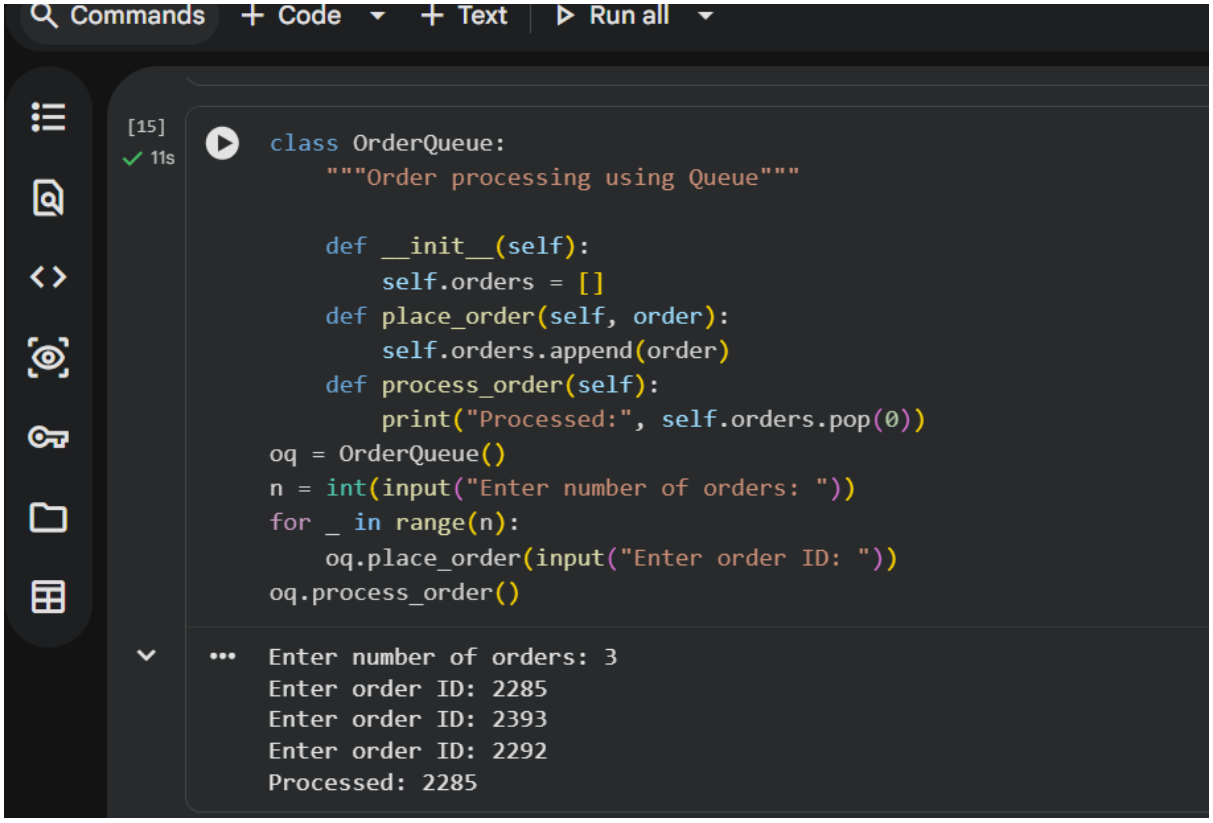
• Justify your choice in 2–3 sentences per feature.

• Implement one selected feature as a working Python program with AI-assisted code generation.

Expected Output:

• A table mapping feature → chosen data structure → justification.

• A functional Python program implementing the chosen feature with comments and docstrings.


Commands
+ Code
+ Text
Run all
[15]
11s
class OrderQueue:
"""Order processing using Queue"""
def __init__(self):
self.orders = []
def place_order(self, order):
self.orders.append(order)
def process_order(self):
print("Processed:", self.orders.pop(0))
oq = OrderQueue()
n = int(input("Enter number of orders: "))
for _ in range(n):
oq.place_order(input("Enter order ID: "))
oq.process_order()
Enter number of orders: 3
Enter order ID: 2285
Enter order ID: 2393
Enter order ID: 2292
Processed: 2285