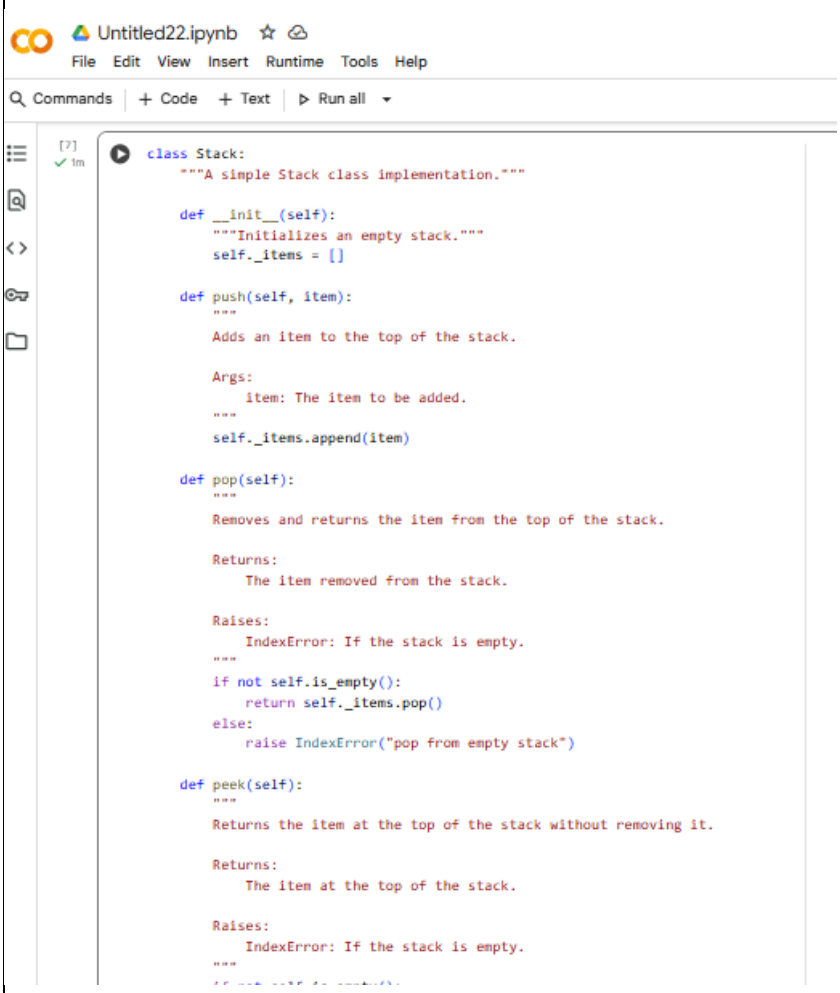
SCHOOL OF COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE		DEPARTMENT OF COMPUTER SCIENCE ENGINEERING	
Program Name: B. Tech		**Assignment Type: Lab**	**Academic Year:**2025-2026
Course Coordinator Name	Venkataramana Veeramsetty		
Instructor(s) Name	Dr. V. Venkataramana (Co-ordinator) Dr. T. Sampath Kumar Dr. Pramoda Patro Dr. Brij Kishor Tiwari Dr.J.Ravichander Dr. Mohammand Ali Shaik Dr. Anirodh Kumar Mr. S.Naresh Kumar Dr. RAJESH VELPULA Mr. Kundhan Kumar Ms. Ch.Rajitha Mr. M Prakash Mr. B.Raju Intern 1 (Dharma teja) Intern 2 (Sai Prasad) Intern 3 (Sowmya) NS_2 (Mounika)		
Course Code	24CS002PC215	**Course Title**	AI Assisted Coding
Year/Sem	II/I	**Regulation**	R24
Date and Day of Assignment	Week6 - Monday	**Time(s)**	
Duration	2 Hours	**Applicable to Batches**	
AssignmentNumber:11.1(Present assignment number)/**24**(Total number of assignments)			

Q.No.	Question	***Expected Time to complete***
1	**Lab 11 – Data Structures with AI: Implementing Fundamental Structures** **Lab Objectives** • Use AI to assist in designing and implementing fundamental data structures in Python.	Week6 - Monday

	• Learn how to prompt AI for structure creation, optimization, and documentation. • Improve understanding of Lists, Stacks, Queues, Linked Lists, Trees, Graphs, and Hash Tables. • Enhance code quality with AI-generated comments and performance suggestions.	
	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. **Prompt:** Generate a Python program that implements a Stack class with push, pop, peek, and is_empty methods and docstrings. **Code:**	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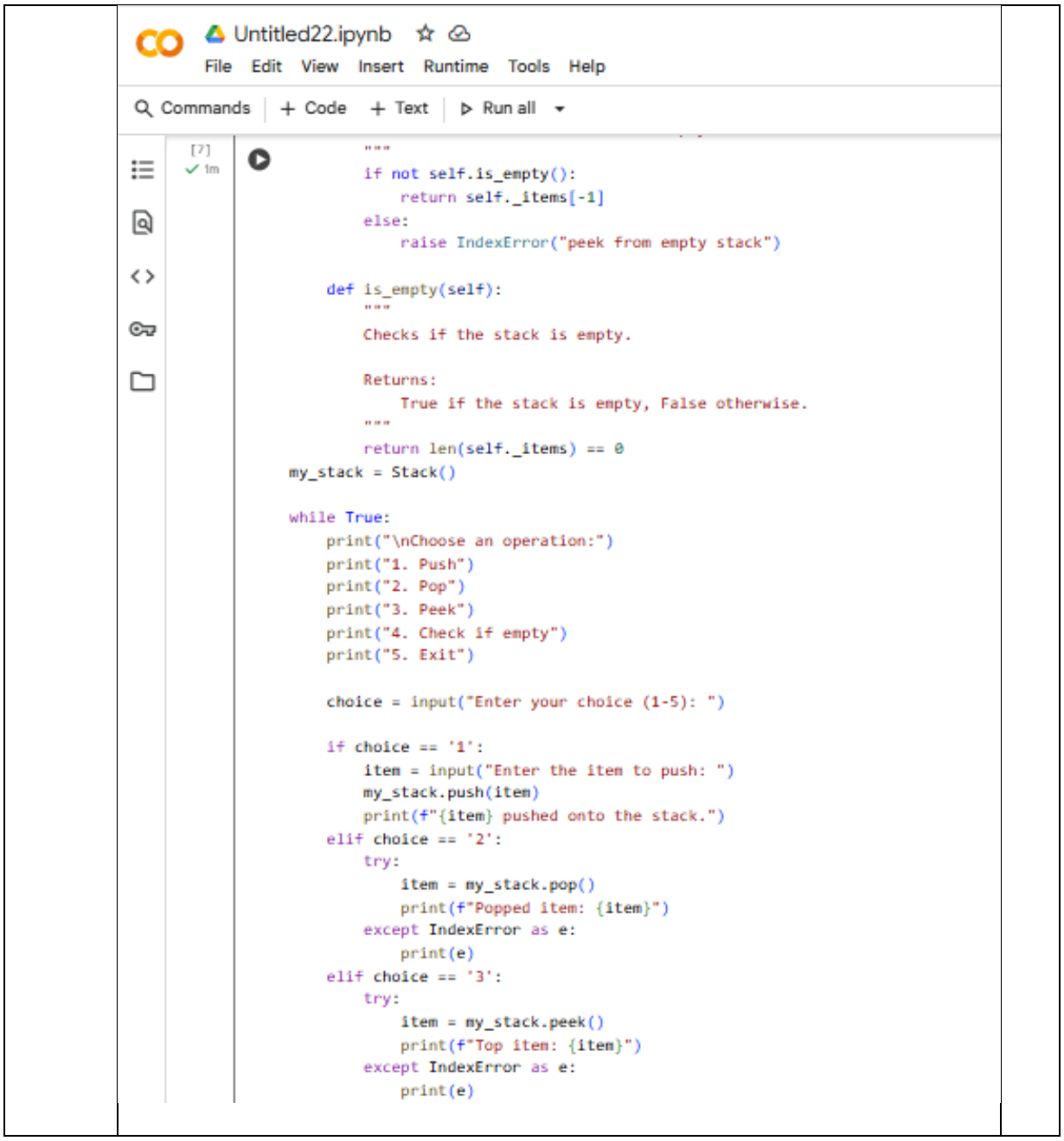
Commands + Code + Text Run all
[7]
1m
class Stack:
"""A simple Stack class implementation."""
def __init__(self):
"""Initializes an empty stack."""
self._items = []
def push(self, item):
"""
Adds an item to the top of the stack.
Args:
item: The item to be added.
"""
self._items.append(item)
def pop(self):
"""
Removes and returns the item from the top of the stack.
Returns:
The item removed from the stack.
Raises:
IndexError: If the stack is empty.
"""
if not self.is_empty():
return self._items.pop()
else:
raise IndexError("pop from empty stack")
def peek(self):
"""
Returns 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.
"""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[7]
1m
"""
if not self.is_empty():
return self._items[-1]
else:
raise IndexError("peek from empty stack")
def is_empty(self):
"""
Checks if the stack is empty.
Returns:
True if the stack is empty, False otherwise.
"""
return len(self._items) == 0
my_stack = Stack()
while True:
print("\nChoose an operation:")
print("1. Push")
print("2. Pop")
print("3. Peek")
print("4. Check if empty")
print("5. Exit")
choice = input("Enter your choice (1-5): ")
if choice == '1':
item = input("Enter the item to push: ")
my_stack.push(item)
print(f"{item} pushed onto the stack.")
elif choice == '2':
try:
item = my_stack.pop()
print(f"Popped item: {item}")
except IndexError as e:
print(e)
elif choice == '3':
try:
item = my_stack.peek()
print(f"Top item: {item}")
except IndexError as e:
print(e)

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```
[7]
✓ 1m
    elif choice == '3':
        try:
            item = my_stack.peek()
            print(f"Top item: {item}")
        except IndexError as e:
            print(e)
    elif choice == '4':
        if my_stack.is_empty():
            print("The stack is empty.")
        else:
            print("The stack is not empty.")
    elif choice == '5':
        print("Exiting.")
        break
    else:
        print("Invalid choice. Please enter a number between 1 and 5.")
```

```
Choose an operation:
1. Push
2. Pop
3. Peek
4. Check if empty
5. Exit
Enter your choice (1-5): 1
Enter the item to push: 12
12 pushed onto the stack.

Choose an operation:
1. Push
2. Pop
3. Peek
4. Check if empty
5. Exit
Enter your choice (1-5): 2
Popped item: 12

Choose an operation:
1. Push
2. Pop
3. Peek
4. Check if empty
5. Exit
Enter your choice (1-5): 3
peek from empty stack

Choose an operation:
1. Push
2. Pop
3. Peek
4. Check if empty
5. Exit
Enter your choice (1-5): 4
The stack is empty.

Choose an operation:
1. Push
2. Pop
3. Peek
4. Check if empty
5. Exit
Enter your choice (1-5): 5
Exiting.
```

Code Explanation:

Class Definition – A Stack class is created to represent the stack data structure.
Push Method – Adds an element to the top of the stack using append().
Pop Method – Removes and returns the top element using pop(). If empty, it shows a warning.
Peek Method – Returns the top element without removing it. If empty, it shows a warning.
is_empty Method – Checks whether the stack has no elements and returns True or False.

Task Description #2 – Queue Implementation

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

Sample Input Code:

```
class Queue:
    pass
```

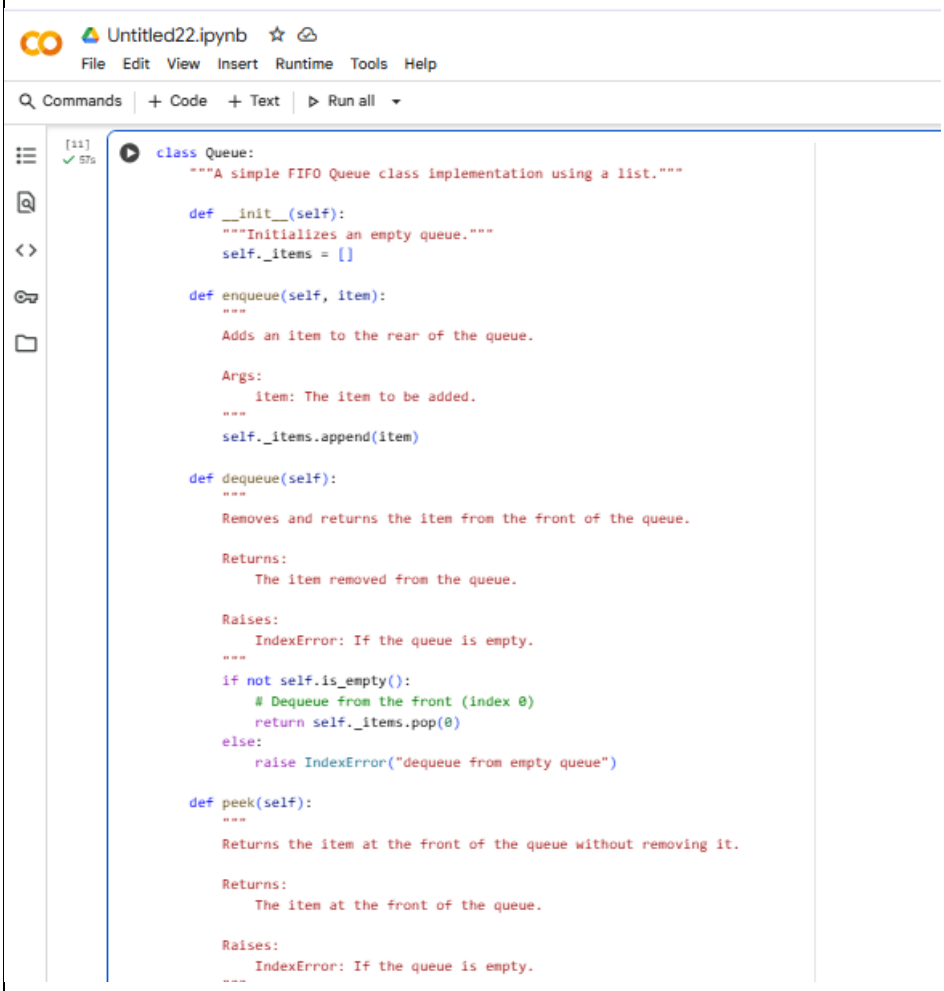
Expected Output:

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

Prompt:

Generate a Python class to implement a Queue using lists with enqueue, dequeue, peek, size, and is_empty methods.

Code:



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```
            if not self.is_empty():
                return self._items[0]
            else:
                raise IndexError("peek from empty queue")

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

            Returns:
                True if the queue is empty, False otherwise.
            """
            return len(self._items) == 0

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

            Returns:
                The number of items in the queue.
            """
            return len(self._items)
    # Create a Queue instance
    my_queue = Queue()

    while True:
        print("\nChoose an operation:")
        print("1. Enqueue")
        print("2. Dequeue")
        print("3. Peek")
        print("4. Check if empty")
        print("5. Get size")
        print("6. Exit")

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

        if choice == '1':
            item = input("Enter the item to enqueue: ")
            my_queue.enqueue(item)
            print(f"{item} enqueued onto the queue.")
        elif choice == '2':
            try:
```

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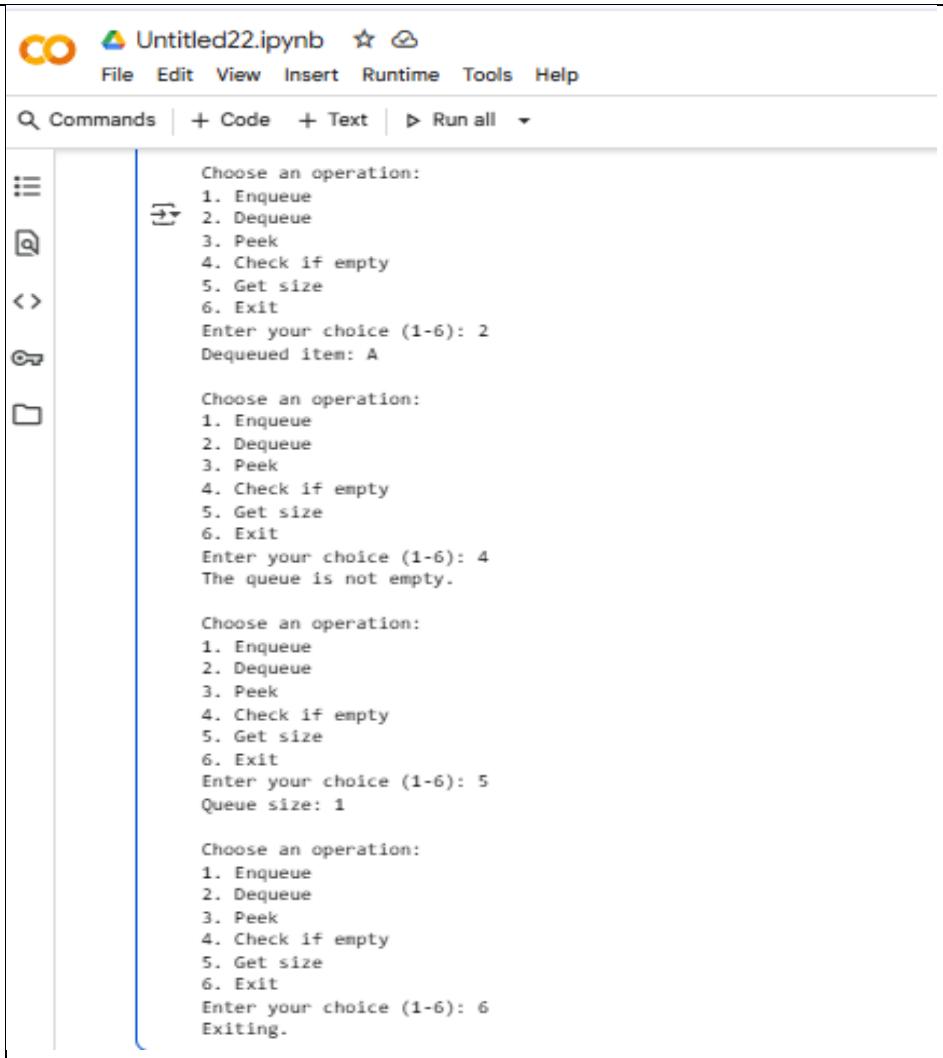
```
                item = my_queue.dequeue()
                print(f"Dequeued item: {item}")
            except IndexError as e:
                print(e)
        elif choice == '3':
            try:
                item = my_queue.peek()
                print(f"Front item: {item}")
            except IndexError as e:
                print(e)
        elif choice == '4':
            if my_queue.is_empty():
                print("The queue is empty.")
            else:
                print("The queue is not empty.")
        elif choice == '5':
            print(f"Queue size: {my_queue.size()}")
        elif choice == '6':
            print("Exiting.")
            break
        else:
            print("Invalid choice. Please enter a number between 1 and 6.")
```

```
2. Dequeue
3. Peek
4. Check if empty
5. Get size
6. Exit
Enter your choice (1-6): 1
Enter the item to enqueue: B
B enqueued onto the queue.

Choose an operation:
1. Enqueue
2. Dequeue
3. Peek
4. Check if empty
5. Get size
6. Exit
Enter your choice (1-6): 3
Front item: A
```



Code Explanation:

Class Definition – A Queue class is created to represent the FIFO queue..
Enqueue () – Adds an element to the end of the queue using append().
Dequeue () – Removes and returns the first element using pop(0). If empty, it shows a warning.
Peek () – Returns the first element without removing it. If empty, it shows a warning.
Size () – Returns the total number of elements currently in the queue.
is_empty() – Checks whether the queue has no elements and returns True or False.

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
```

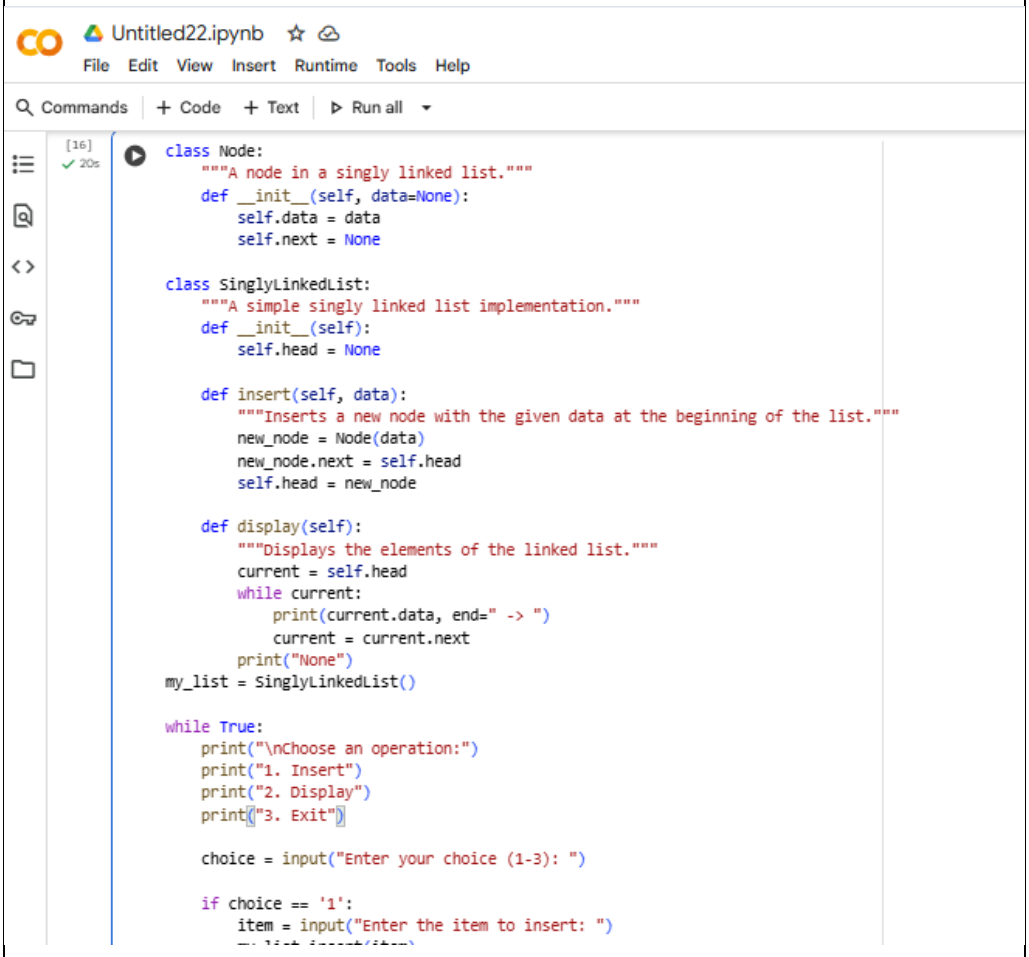
Expected Output:

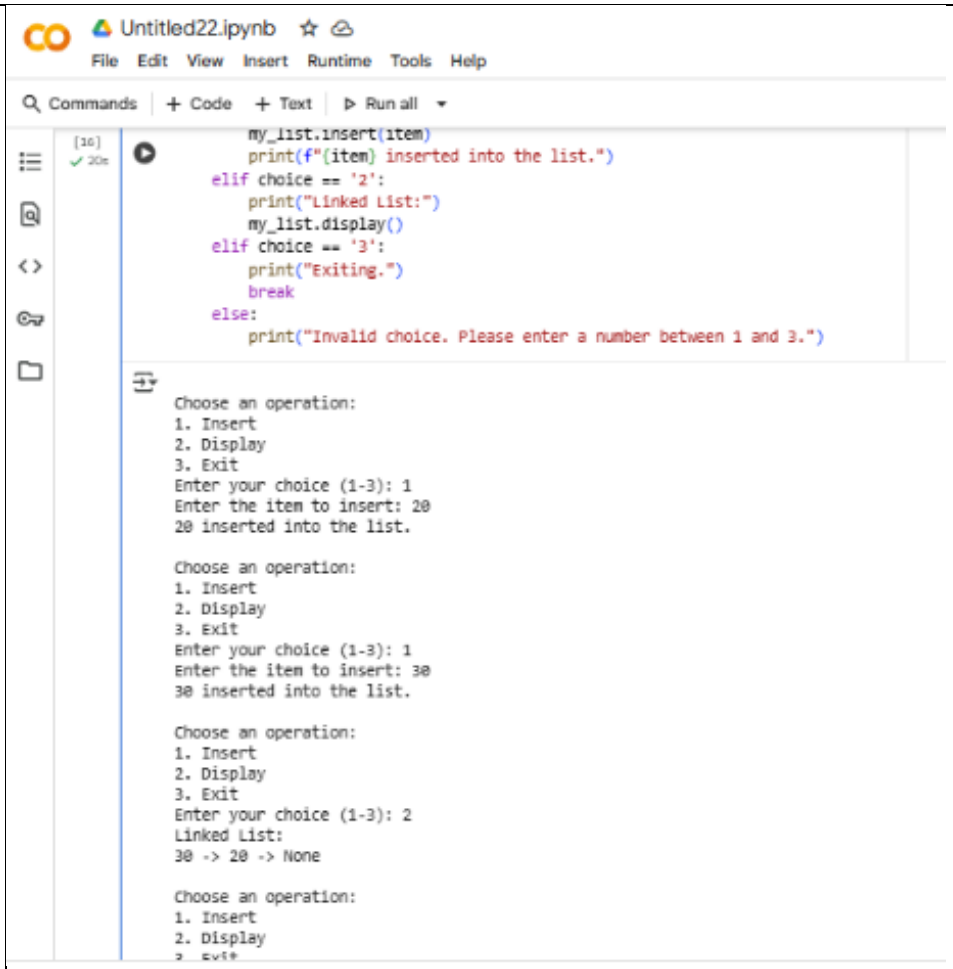
- A working linked list implementation with clear method documentation.

Prompt:

Generate a Python program to implement a Singly Linked List with insert and display methods, including docstrings.

Code:





Code Explanation:

Node class – Defines each element of the linked list with data (value) and next (pointer to next node).

LinkedList class – Manages the list using the head pointer that refers to the first node.

insert(value) – Creates a new node and appends it at the end of the list; if the list is empty, the new node becomes the head.

Display () – Traverses from head to tail, collects node values in a list, and prints them in a readable format

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
```

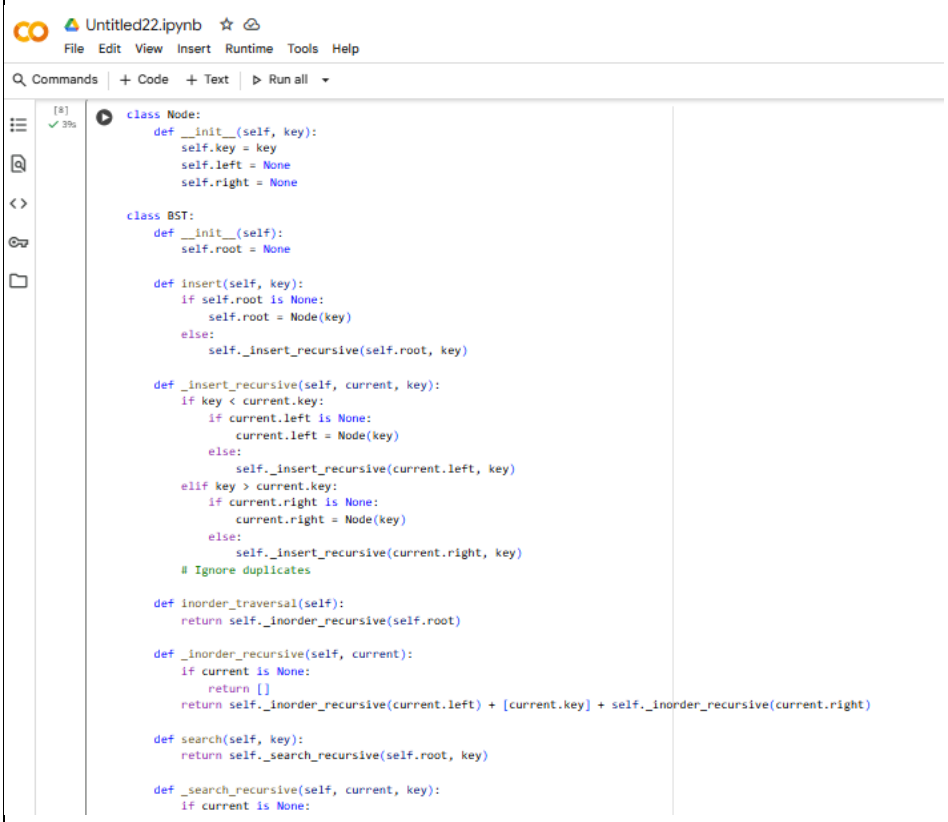
Expected Output:

- BST implementation with recursive insert and traversal methods.

Prompt:

Generate a Python program to implement a Binary Search Tree (BST) with recursive insert and in-order traversal methods.

Code:



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```
            elif key < current.key:
                return self._search_recursive(current.left, key)
            else:
                return self._search_recursive(current.right, key)
    # ---------- Menu Driven Program ----------
    bst = BST()
    while True:
        print("\n---- Binary Search Tree Menu ----")
        print("1. Insert")
        print("2. In-order Traversal")
        print("3. Search")
        print("4. Exit")
        choice = input("Enter your choice: ")
        if choice == '1':
            while True:
                val_str = input("Enter value to insert: ")
                try:
                    val = int(val_str)
                    bst.insert(val)
                    print(f"{val} inserted into BST.")
                    break
                except ValueError:
                    print("Invalid input. Please enter an integer.")
        elif choice == '2':
            print("In-order Traversal:", bst.inorder_traversal())
        elif choice == '3':
            while True:
                val_str = input("Enter value to search: ")
                try:
                    val = int(val_str)
                    if bst.search(val):
                        print(f"{val} found in BST.")
                    else:
                        print(f"{val} not found in BST.")
                    break
                except ValueError:
                    print("Invalid input. Please enter an integer.")
        elif choice == '4':
            print("Exiting program...")
            break
        else:
            print("Invalid choice! Please try again.")
```

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```
            print("Invalid choice! Please try again.")
```

```
---- Binary Search Tree Menu ----
1. Insert
2. In-order Traversal
3. Search
4. Exit
Enter your choice: 1
Enter value to insert: 30
30 inserted into BST.

---- Binary Search Tree Menu ----
1. Insert
2. In-order Traversal
3. Search
4. Exit
Enter your choice: 1
Enter value to insert: 10
10 inserted into BST.

---- Binary Search Tree Menu ----
1. Insert
2. In-order Traversal
3. Search
4. Exit
Enter your choice: 2
In-order Traversal: [10, 30]

---- Binary Search Tree Menu ----
1. Insert
2. In-order Traversal
3. Search
4. Exit
Enter your choice: 3
Enter value to search: 30
30 found in BST.

---- Binary Search Tree Menu ----
1. Insert
2. In-order Traversal
3. Search
4. Exit
Enter your choice: 4
Exiting program...
```

Code Explanation:

Node class – Defines a tree node with `key`, `left`, and `right` attributes.

BST class – Manages the Binary Search Tree with a `root` pointer.

insert(key) – Public method that calls a recursive helper to place the new key in the correct position.

insert_recursive(node, key) – Recursively finds the correct spot: smaller values go left, larger values go right.

inorder_traversal() – Returns the elements of the BST in ascending order using recursion.

Task Description #5 – Hash Table

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

Sample Input Code:

```
class HashTable:
    pass
```

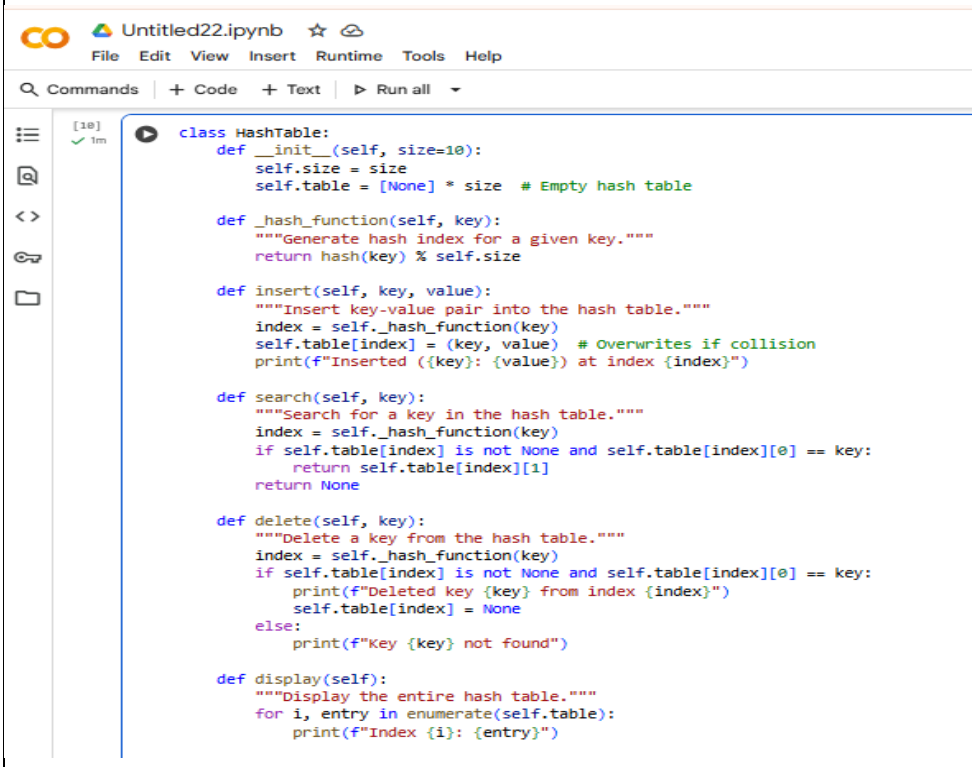
Expected Output:

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

Prompt:

Generate a Python program to implement a Hash Table with insert, search, and delete methods using chaining for collision handling, including docstrings.

Code:



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```
# -------- Menu Driven Program --------
size = int(input("Enter size of hash table: "))
ht = HashTable(size)

while True:
    print("\n---- Hash Table Menu ----")
    print("1. Insert")
    print("2. Search")
    print("3. Delete")
    print("4. Display")
    print("5. Exit")

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

    if choice == 1:
        key = input("Enter key: ")
        value = input("Enter value: ")
        ht.insert(key, value)
    elif choice == 2:
        key = input("Enter key to search: ")
        result = ht.search(key)
        if result is not None:
            print(f"Found: {key} -> {result}")
        else:
            print("Key not found.")
    elif choice == 3:
        key = input("Enter key to delete: ")
        ht.delete(key)
    elif choice == 4:
        ht.display()
    elif choice == 5:
        print("Exiting program...")
        break
    else:
        print("Invalid choice! Try again.")
```

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```
1. Insert
2. Search
3. Delete
4. Display
5. Exit
Enter your choice: 1
Enter key: pen
Enter value: 10
Inserted (pen: 10) at index 1

---- Hash Table Menu ----
1. Insert
2. Search
3. Delete
4. Display
5. Exit
Enter your choice: 2
Enter key to search: pen
Found: pen -> 10

---- Hash Table Menu ----
1. Insert
2. Search
3. Delete
4. Display
5. Exit
Enter your choice: 4
Index 0: None
Index 1: ('pen', '10')

---- Hash Table Menu ----
1. Insert
2. Search
3. Delete
4. Display
5. Exit
Enter your choice: 3
Enter key to delete: pen
Deleted key pen from index 1

---- Hash Table Menu ----
1. Insert
2. Search
3. Delete
4. Display
5. Exit
Enter your choice: 5
```

Code Explanation:

Initialization – Creates a hash table with a fixed number of buckets, each represented as a list for chaining collisions.

Hash Function – Uses Python's built-in hash() and modulo operator to map a key to an index within the table size.

Insert – Finds the correct bucket using the hash function; if the key already exists, updates its value, otherwise appends a new (key, value) pair.

Search – Looks in the bucket for the given key and returns its value if found; returns None if the key is absent.

Delete – Finds the bucket, searches for the key, and removes the key-value pair if it exists; otherwise shows a warning message.

Display – Prints the current state of the hash table, showing each index and its chained list of key-value pairs.

Task Description #6 – Graph Representation

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

Sample Input Code:

class Graph:

pass

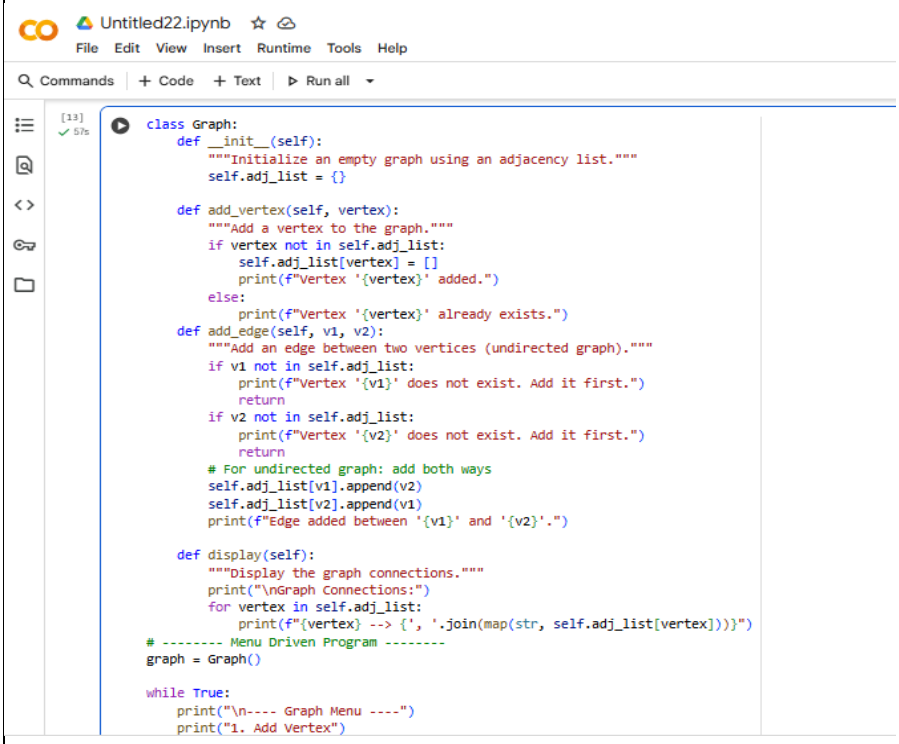
Expected Output:

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

Prompt:

Generate a code to implement a graph using an adjacency list. The graph should have methods to add vertices, add edges, check connections, and display the graph.

Code:



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```
print("2. Add Edge")
print("3. Display Graph")
print("4. Exit")
choice = int(input("Enter your choice: "))
if choice == 1:
    v = input("Enter vertex name: ")
    graph.add_vertex(v)
elif choice == 2:
    v1 = input("Enter first vertex: ")
    v2 = input("Enter second vertex: ")
    graph.add_edge(v1, v2)
elif choice == 3:
    graph.display()
elif choice == 4:
    print("Exiting program...")
    break
else:
    print("Invalid choice! Try again.")
```

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```
---- Graph Menu ----
1. Add Vertex
2. Add Edge
3. Display Graph
4. Exit
Enter your choice: 1
Enter vertex name: A
Vertex 'A' added.

---- Graph Menu ----
1. Add Vertex
2. Add Edge
3. Display Graph
4. Exit
Enter your choice: 1
Enter vertex name: B
Vertex 'B' added.

---- Graph Menu ----
1. Add Vertex
2. Add Edge
3. Display Graph
4. Exit
Enter your choice: 2
Enter first vertex: A
Enter second vertex: B
Edge added between 'A' and 'B'.

---- Graph Menu ----
1. Add Vertex
2. Add Edge
3. Display Graph
4. Exit
Enter your choice: 3

Graph Connections:
A --> B
B --> A

---- Graph Menu ----
1. Add Vertex
2. Add Edge
3. Display Graph
4. Exit
Enter your choice: 4
Exiting program...
```

Variables Terminal

Code Explanation:

1. Graph is stored as a dictionary.

2.**add_vertex(v)** → Adds a new vertex if it doesn't exist.

3.**add_edge(u, v)** → Adds an edge between two vertices.

4. **display()** → Prints the graph in adjacency list form.

Task Description #7 – Priority Queue

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

Sample Input Code:

```
class PriorityQueue:
    pass
```

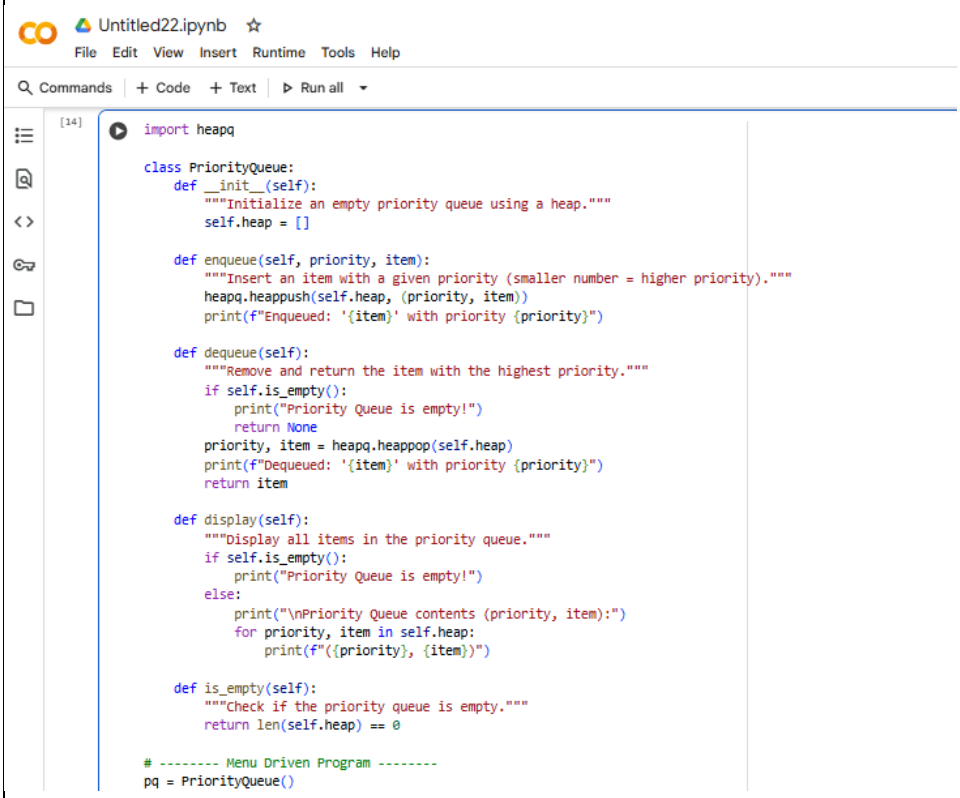
Expected Output:

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

Prompt:

Use AI to implement a priority queue using Python's heapq module. The class should support methods like enqueue , dequeue, check if the queue is empty, and display contents.

Code:



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[14]

```
# -------- Menu Driven Program --------
pq = PriorityQueue()

while True:
    print("\n---- Priority Queue Menu ----")
    print("1. Enqueue")
    print("2. Dequeue")
    print("3. Display")
    print("4. Exit")

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

    if choice == 1:
        item = input("Enter item: ")
        priority = int(input("Enter priority (smaller number = higher priority): "))
        pq.enqueue(priority, item)
    elif choice == 2:
        pq.dequeue()
    elif choice == 3:
        pq.display()
    elif choice == 4:
        print("Exiting program...")
        break
    else:
        print("Invalid choice! Try again.")
```

```
---- Priority Queue Menu ----
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 1
Enter item: Task A
Enter priority (smaller number = higher priority): 1
Enqueued: 'Task A' with priority 1
```

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```
Enter priority (smaller number = higher priority): 3
Enqueued: 'Task B' with priority 3

---- Priority Queue Menu ----
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 1
Enter item: Task C
Enter priority (smaller number = higher priority): 2
Enqueued: 'Task C' with priority 2

---- Priority Queue Menu ----
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 3

Priority Queue contents (priority, item):
(1, Task A)
(3, Task B)
(2, Task C)

---- Priority Queue Menu ----
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 2
Dequeued: 'Task A' with priority 1

---- Priority Queue Menu ----
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 4
Exiting program...
```

Variables Terminal

Code Explanation:

1.**Uses heapq**- Python's built-in module to create a priority queue.

2.__init__ → Initializes an empty list to act as the heap.

3.Enqueue (item, priority) → Adds an element with its priority into the heap.

4.Dequeue () → Removes and returns the element with the highest priority.

5.Display () → Prints all items with their priorities.

6.is_empty() → Checks if the queue is empty.

Task Description #8 – Deque

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

Sample Input Code:

```
class DequeDS:
    pass
```

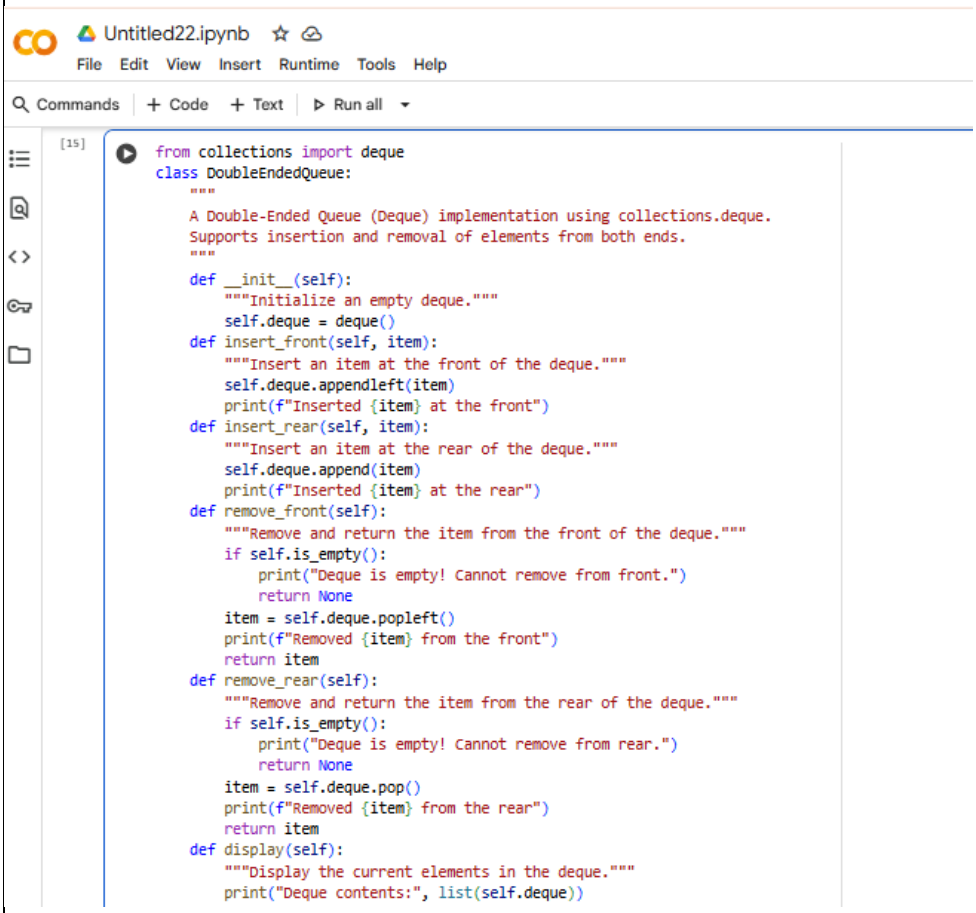
Expected Output:

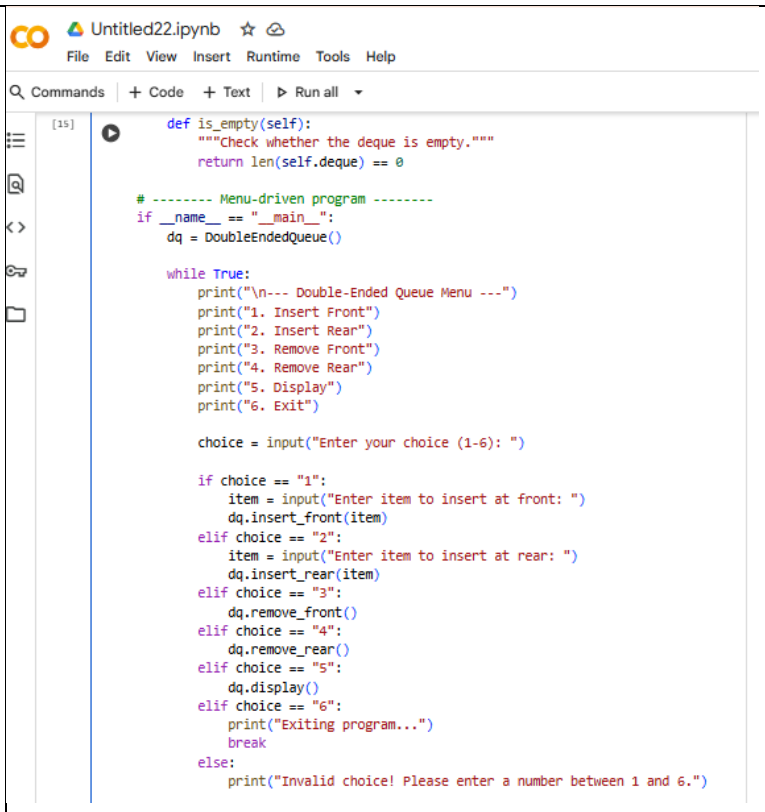
- Insert and remove from both ends with docstrings.

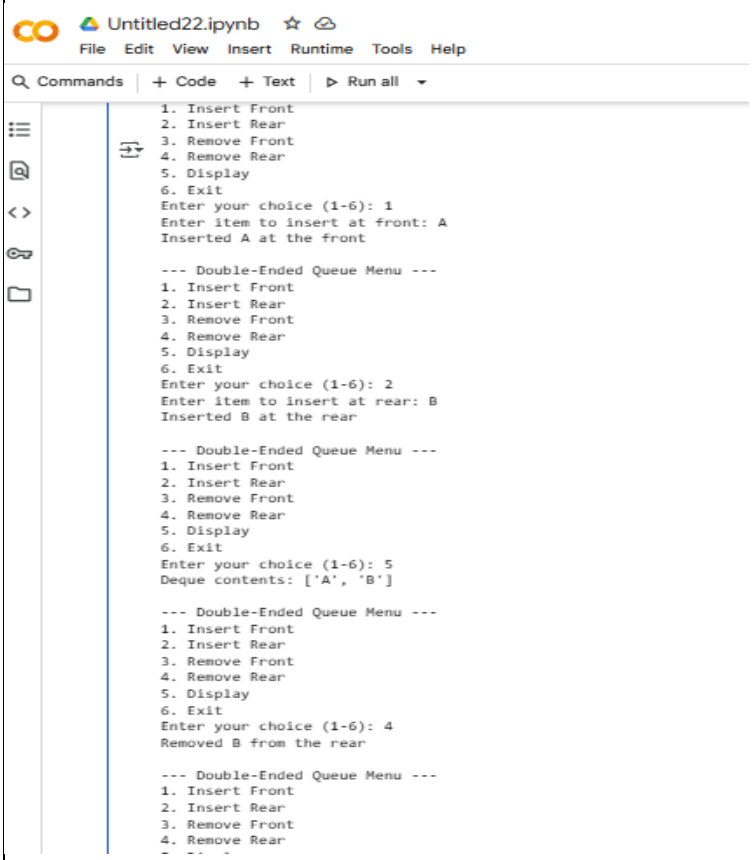
Prompt:

Generate code to implement a double-ended queue using collections.deque. The class should support methods to insert and remove elements from both the front and rear, check if the deque is empty, and display its contents. Include docstrings for each method.

Code:




Untitled22.ipynb
File Edit View Insert Runtime Tools Help
Commands + Code + Text Run all
[15]
def is_empty(self):
"""Check whether the deque is empty."""
return len(self.deque) == 0
# -------- Menu-driven program --------
if __name__ == "__main__":
dq = DoubleEndedQueue()
while True:
print("\n--- Double-Ended Queue Menu ---")
print("1. Insert Front")
print("2. Insert Rear")
print("3. Remove Front")
print("4. Remove Rear")
print("5. Display")
print("6. Exit")
choice = input("Enter your choice (1-6): ")
if choice == "1":
item = input("Enter item to insert at front: ")
dq.insert_front(item)
elif choice == "2":
item = input("Enter item to insert at rear: ")
dq.insert_rear(item)
elif choice == "3":
dq.remove_front()
elif choice == "4":
dq.remove_rear()
elif choice == "5":
dq.display()
elif choice == "6":
print("Exiting program...")
break
else:
print("Invalid choice! Please enter a number between 1 and 6.")


Untitled22.ipynb
File Edit View Insert Runtime Tools Help
Commands + Code + Text Run all
1. Insert Front
2. Insert Rear
3. Remove Front
4. Remove Rear
5. Display
6. Exit
Enter your choice (1-6): 1
Enter item to insert at front: A
Inserted A at the front
--- Double-Ended Queue Menu ---
1. Insert Front
2. Insert Rear
3. Remove Front
4. Remove Rear
5. Display
6. Exit
Enter your choice (1-6): 2
Enter item to insert at rear: B
Inserted B at the rear
--- Double-Ended Queue Menu ---
1. Insert Front
2. Insert Rear
3. Remove Front
4. Remove Rear
5. Display
6. Exit
Enter your choice (1-6): 5
Deque contents: ['A', 'B']
--- Double-Ended Queue Menu ---
1. Insert Front
2. Insert Rear
3. Remove Front
4. Remove Rear
5. Display
6. Exit
Enter your choice (1-6): 4
Removed B from the rear
--- Double-Ended Queue Menu ---
1. Insert Front
2. Insert Rear
3. Remove Front
4. Remove Rear

Code Expanation:

1.collections.deque - A built-in Python class that allows fast insert and delete from both ends.
2._init__ - Creates an empty deque.
3.insert_front(item) - Adds an element at the front.
4.insert_rear(item) - Adds an element at the rear (end).
5.remove_front() - Removes and returns the front element.
6.remove_rear() - Removes and returns the rear element.
7.display() - Prints the current contents of the deque.
8.is_empty() - Checks if the deque has no elements.

Task Description #9 – AI-Generated Data Structure Comparisons

Task: Use AI to generate a comparison table of different data structures (stack, queue, linked list, etc.) including time complexities.
Sample Input Code:
No code, prompt AI for a data structure comparison table
Expected Output:

- A markdown table with structure names, operations, and complexities.

Comparison Table:

Data Structure	Operation	Average Time Complexity	Worst-Case Time Complexity	Notes
Array	Access	O(1)	O(1)	
	Search	O(n)	O(n)	Unsorted array
	Insertion (end)	O(1)	O(n)	Amortized for dynamic arrays, O(n) if resize
	Insertion (middle)	O(n)	O(n)	
	Deletion (end)	O(1)	O(1)	
	Deletion (middle)	O(n)	O(n)	
Linked List	Access	O(n)	O(n)	
	Search	O(n)	O(n)	
	Insertion (front)	O(1)	O(1)	
	Insertion (end)	O(n)	O(n)	O(1) if tail pointer is maintained
	Deletion (front)	O(1)	O(1)	
	Deletion (end)	O(n)	O(n)	O(1) with doubly linked list and tail pointer
Doubly Linked List	Insertion (front)	O(1)	O(1)	
	Insertion (end)	O(1)	O(1)	
	Deletion (front)	O(1)	O(1)	
	Deletion (end)	O(1)	O(1)	
Stack	Push	O(1)	O(1)	Using array or linked list
	Pop	O(1)	O(1)	Using array or linked list
	Peek	O(1)	O(1)	Using array or linked list
Queue	Enqueue	O(1)	O(1)	Using linked list or deque
	Dequeue	O(1)	O(1)	Using linked list or deque
	Peek	O(1)	O(1)	Using linked list or deque
Hash Table	Insert	O(1)	O(n)	Average case assumes good hash function and low collision
	Search	O(1)	O(n)	Average case assumes good hash function and low collision
	Delete	O(1)	O(n)	Average case assumes good hash function and low collision
Binary Search Tree	Insert	O(log n)	O(n)	O(n) in case of skewed tree
	Search	O(log n)	O(n)	O(n) in case of skewed tree
	Deletion	O(log n)	O(n)	O(n) in case of skewed tree

Variables Terminal

Task Description #10 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:
  - Stack
  - Queue
  - Priority Queue
  - Linked List
  - Binary Search Tree (BST)
  - Graph
  - Hash Table
  - 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.

Prompt:

Generate a Python program to simulate a Cafeteria Order Queue system using a queue data structure. The program should allow students to arrive, be added to the queue, and be served in the order they arrived.

Code:

Feature	Chosen Data Structure
Student Attendance Tracking	Hash Table
Event Registration System	Hash Table
Library Book Borrowing	Hash Table
Bus Scheduling System	Graph
Cafeteria Order Queue	Queue

```python
from queue import Queue

class CafeteriaOrderQueue:
    """
    A cafeteria order management system using a Queue.
    Implements FIFO (First-In, First-Out).
    """

    def __init__(self):
        self.queue = Queue()

    def place_order(self, student_name, order_item):
        """Add a new order to the queue."""
        self.queue.put((student_name, order_item))
        print(f"✅ Order placed: {student_name} ordered {order_item}")

    def serve_order(self):
        """Serve the next order in the queue."""
        if not self.queue.empty():
            student_name, order_item = self.queue.get()
            print(f"🍽️ Order served: {student_name}'s {order_item}")
        else:
            print("⚠️ No pending orders!")

    def display_orders(self):
        """Display all pending orders (snapshot)."""
        if self.queue.empty():
            print("⚠️ No orders in the queue.")
        else:
            print("\n📋 Pending Orders:")
            # Convert queue to list for snapshot
            temp_list = list(self.queue.queue)
            for student, item in temp_list:
                print(f"- {student} ordered {item}")

# ---------- User Input Menu ----------
```

```python
if __name__ == "__main__":
    cafeteria = CafeteriaOrderQueue()

    while True:
        print("\n===== Cafeteria Order Queue =====")
        print("1. Place Order")
        print("2. Serve Order")
        print("3. Display Orders")
        print("4. Exit")

        choice = input("Enter your choice (1-4): ")

        if choice == "1":
            name = input("Enter student name: ")
            item = input("Enter order item: ")
            cafeteria.place_order(name, item)

        elif choice == "2":
            cafeteria.serve_order()

        elif choice == "3":
            cafeteria.display_orders()

        elif choice == "4":
            print("👋 Exiting... Thank you!")
            break

        else:
            print("⚠️ Invalid choice. Please enter 1-4.")
```

```
===== Cafeteria Order Queue =====
1. Place Order
2. Serve Order
3. Display Orders
4. Exit
```

es Terminal

```
Enter your choice (1-4): 1
Enter student name: charan
Enter order item: pizza
✅ Order placed: charan ordered pizza

===== Cafeteria Order Queue =====
1. Place Order
2. Serve Order
3. Display Orders
4. Exit
Enter your choice (1-4): 1
Enter student name: vishnu
Enter order item: Burger
✅ Order placed: vishnu ordered Burger

===== Cafeteria Order Queue =====
1. Place Order
2. Serve Order
3. Display Orders
4. Exit
Enter your choice (1-4): 2
🍽️ Order served: charan's pizza

===== Cafeteria Order Queue =====
1. Place Order
2. Serve Order
3. Display Orders
4. Exit
Enter your choice (1-4): 3

📋 Pending Orders:
- vishnu ordered Burger

===== Cafeteria Order Queue =====
1. Place Order
2. Serve Order
3. Display Orders
4. Exit
Enter your choice (1-4): 4
👋 Exiting... Thank you!
```

Code Explanation:

1. **Class: CafeteriaOrderQueue** - Manages cafeteria orders using a queue.
2. **init__()**:Creates an empty queue for storing orders.
3. **place_order(student_name, order_item)**:Adds a new order to the queue.Shows a message confirming the order.
4. **serve_order()**:Serves (removes) the first order in the queue.
5. **display_orders()**:Shows all current orders in the queue.

✅ Deliverables (For All Tasks)

1. AI-generated prompts for code and test case generation.
2. At least 3 assert test cases for each task.
3. AI-generated initial code and execution screenshots.
4. Analysis of whether code passes all tests.
5. Improved final version with inline comments and explanation.
6. Compiled report (Word/PDF) with prompts, test cases, assertions, code, and output.