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	Dr. Rishabh Mittal
Instructor(s) Name	Mr. S Naresh Kumar Ms. B. Swathi Dr. Sasanko Shekhar Gantayat Mr. Md Sallauddin Dr. Mathivanan Mr. Y Srikanth Ms. N Shilpa Dr. Rishabh Mittal (Coordinator) Dr. R. Prashant Kumar Mr. Ankushavali MD Mr. B Viswanath Ms. Sujitha Reddy Ms. A. Anitha Ms. M.Madhuri Ms. Katherashala Swetha Ms. Velpula sumalatha Mr. Bingi Raju

Course Code	23CS002PC304	**Course Title**	AI Assisted Coding
Year/Sem	III/II	**Regulation**	R23
Date and Day of Assignment	**Week6 – Wednesday**	**Time(s)**	23CSBTB01 To 23CSBTB52
Duration	2 Hours	**Applicable to Batches**	All batches

Assignment Number:11.3(Present assignment number)/**24**(Total number of assignments)

Q.No.	**Question**	***Expected Time to complete***
1	**Lab 11: Data Structures with AI Implementing Fundamental Data Structures using AI Assistance**	Week6 -

Wednesday

Lab Objectives:

By the end of this lab, students will be able to:

- Design and implement fundamental data structures in Python using AI assistance.
- Effectively prompt AI tools (e.g., GitHub Copilot) for code generation, optimization, and documentation.
- Understand and compare core data structures: Arrays, Linked Lists, Stacks, Queues, Priority Queues, Trees, and Graphs.
- Improve code readability, efficiency, and maintainability using AI-generated suggestions.

Learning Outcomes

After completing this lab, students will be able to:

- Apply appropriate data structures to solve real-world problems.
- Analyze time and space complexity of different data structure operations.
- Use AI tools responsibly to assist (not replace) logical thinking and problem-solving.
- Validate, test, and refine AI-generated code.

Task 1: Smart Contact Manager (Arrays & Linked Lists)

Scenario

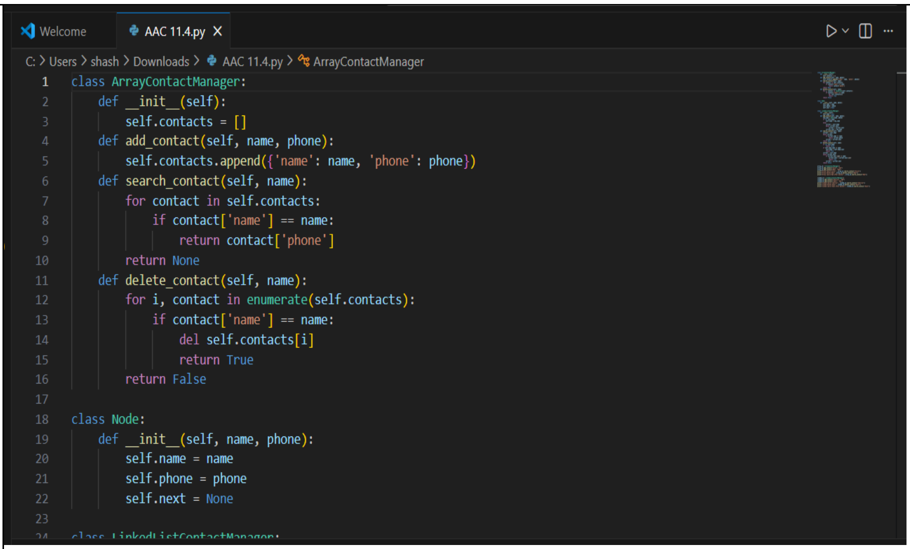
SR University’s student club requires a simple **Contact Manager Application** to store members’ names and phone numbers. The system should support efficient addition, searching, and deletion of contacts.

Tasks

1. Implement the contact manager using **arrays (lists)**.
2. Implement the same functionality using a **linked list** for dynamic memory allocation.
3. Implement the following operations in both approaches:
   - Add a contact
   - Search for a contact
   - Delete a contact
4. Use **GitHub Copilot** to assist in generating search and delete methods.
5. Compare **array vs. linked list** approaches with respect to:
   - Insertion efficiency
   - Deletion efficiency

Expected Outcome

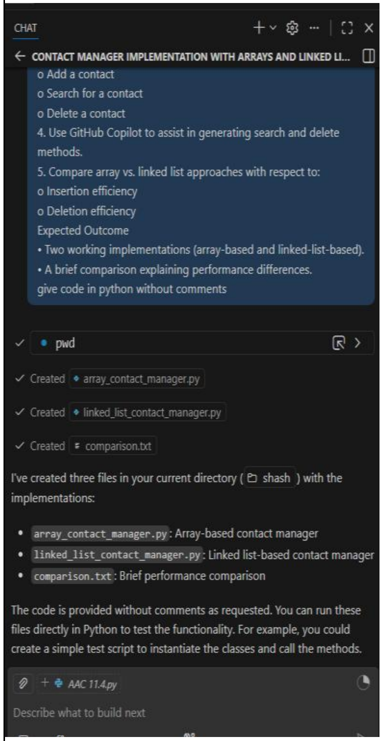
- Two working implementations (array-based and linked-list-based).
- A brief comparison explaining performance differences.


Welcome
AAC 11.4.py
C: > Users > shash > Downloads > AAC 11.4.py > ArrayContactManager

```python
class ArrayContactManager:
    def __init__(self):
        self.contacts = []
    def add_contact(self, name, phone):
        self.contacts.append({'name': name, 'phone': phone})
    def search_contact(self, name):
        for contact in self.contacts:
            if contact['name'] == name:
                return contact['phone']
        return None
    def delete_contact(self, name):
        for i, contact in enumerate(self.contacts):
            if contact['name'] == name:
                del self.contacts[i]
                return True
        return False

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

class LinkedListContactManager:
```



o Add a contact
o Search for a contact
o Delete a contact
4. Use GitHub Copilot to assist in generating search and delete methods.
5. Compare array vs. linked list approaches with respect to:
o Insertion efficiency
o Deletion efficiency
Expected Outcome
• Two working implementations (array-based and linked-list-based).
• A brief comparison explaining performance differences.
give code in python without comments

✓ pwd

✓ Created array_contact_manager.py

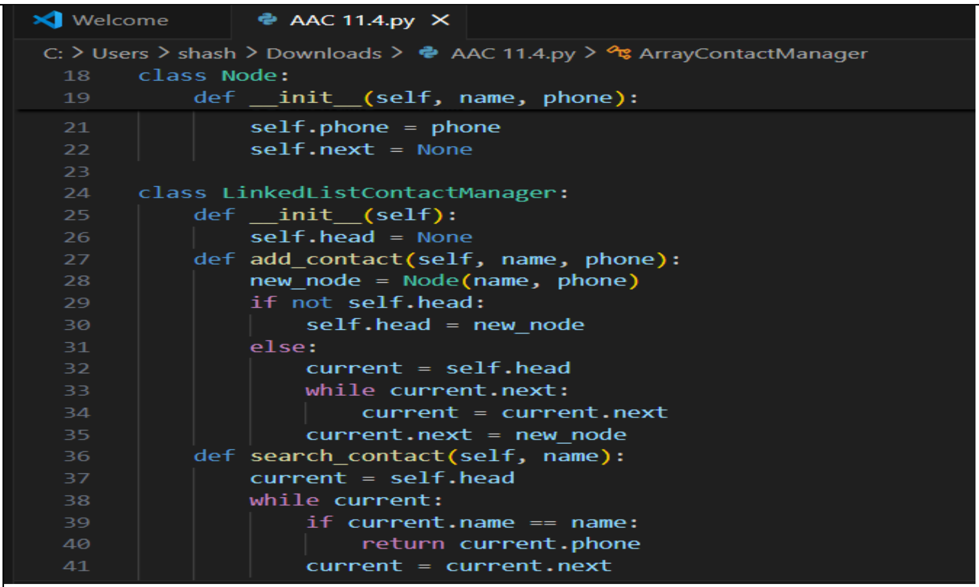
✓ Created linked_list_contact_manager.py

✓ Created comparison.txt

I've created three files in your current directory (shash) with the implementations:

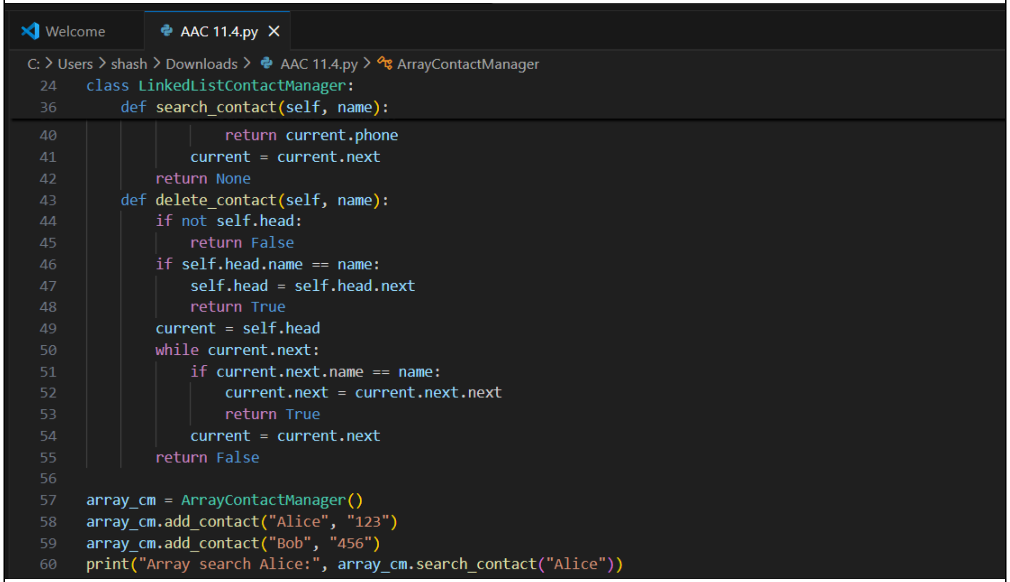
- `array_contact_manager.py`: Array-based contact manager
- `linked_list_contact_manager.py`: Linked list-based contact manager
- `comparison.txt`: Brief performance comparison

The code is provided without comments as requested. You can run these files directly in Python to test the functionality. For example, you could create a simple test script to instantiate the classes and call the methods.


Welcome
AAC 11.4.py
C: > Users > shash > Downloads > AAC 11.4.py > ArrayContactManager

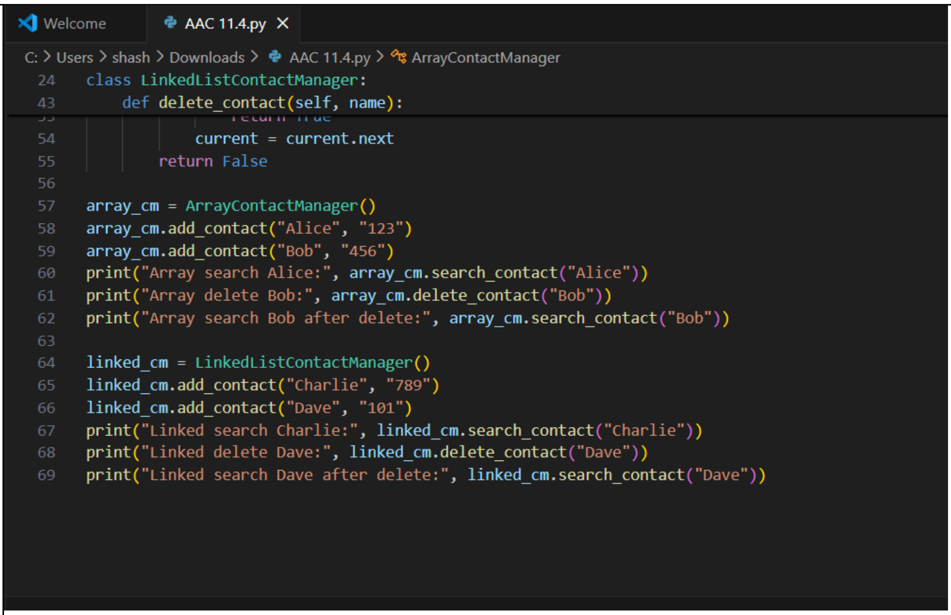
```python
class Node:
    def __init__(self, name, phone):
        self.phone = phone
        self.next = None

class LinkedListContactManager:
    def __init__(self):
        self.head = None
    def add_contact(self, name, phone):
        new_node = Node(name, phone)
        if not self.head:
            self.head = new_node
        else:
            current = self.head
            while current.next:
                current = current.next
            current.next = new_node
    def search_contact(self, name):
        current = self.head
        while current:
            if current.name == name:
                return current.phone
            current = current.next
```


Welcome
AAC 11.4.py
C: > Users > shash > Downloads > AAC 11.4.py > ArrayContactManager

```python
class LinkedListContactManager:
    def search_contact(self, name):
                return current.phone
            current = current.next
        return None
    def delete_contact(self, name):
        if not self.head:
            return False
        if self.head.name == name:
            self.head = self.head.next
            return True
        current = self.head
        while current.next:
            if current.next.name == name:
                current.next = current.next.next
                return True
            current = current.next
        return False

array_cm = ArrayContactManager()
array_cm.add_contact("Alice", "123")
array_cm.add_contact("Bob", "456")
print("Array search Alice:", array_cm.search_contact("Alice"))
```


Welcome
AAC 11.4.py
C: > Users > shash > Downloads > AAC 11.4.py > ArrayContactManager

```
class LinkedListContactManager:
    def delete_contact(self, name):
            current = current.next
        return False

array_cm = ArrayContactManager()
array_cm.add_contact("Alice", "123")
array_cm.add_contact("Bob", "456")
print("Array search Alice:", array_cm.search_contact("Alice"))
print("Array delete Bob:", array_cm.delete_contact("Bob"))
print("Array search Bob after delete:", array_cm.search_contact("Bob"))

linked_cm = LinkedListContactManager()
linked_cm.add_contact("Charlie", "789")
linked_cm.add_contact("Dave", "101")
print("Linked search Charlie:", linked_cm.search_contact("Charlie"))
print("Linked delete Dave:", linked_cm.delete_contact("Dave"))
print("Linked search Dave after delete:", linked_cm.search_contact("Dave"))
```

Task 2: Library Book Search System (Queues & Priority Queues)

Scenario

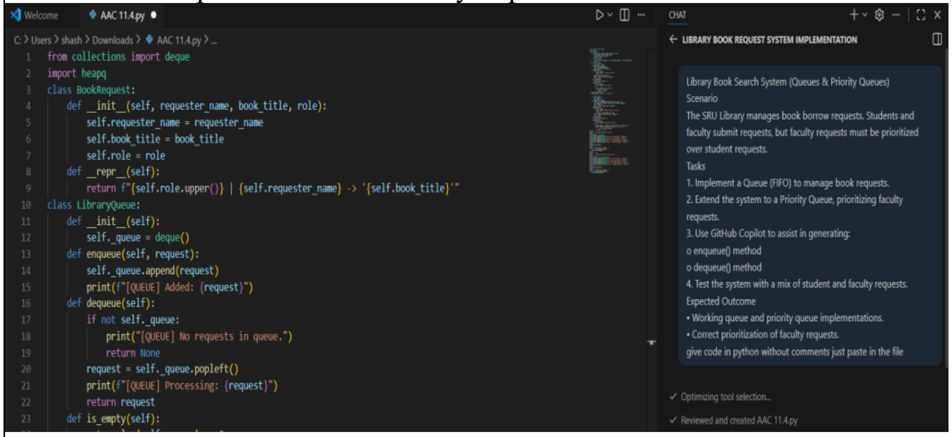
The SRU Library manages book borrow requests. Students and faculty submit requests, but **faculty requests must be prioritized** over student requests.

Tasks

1. Implement a **Queue (FIFO)** to manage book requests.
2. Extend the system to a **Priority Queue**, prioritizing faculty requests.
3. Use **GitHub Copilot** to assist in generating:
    - enqueue() method
    - dequeue() method
4. Test the system with a mix of student and faculty requests.

Expected Outcome

- Working queue and priority queue implementations.
- Correct prioritization of faculty requests.


Welcome
AAC 11.4.py
C: > Users > shash > Downloads > AAC 11.4.py > ...
CHAT
LIBRARY BOOK REQUEST SYSTEM IMPLEMENTATION

```
from collections import deque
import heapq
class BookRequest:
    def __init__(self, requester_name, book_title, role):
        self.requester_name = requester_name
        self.book_title = book_title
        self.role = role
    def __repr__(self):
        return f"{self.role.upper()} | {self.requester_name} -> '{self.book_title}'"
class LibraryQueue:
    def __init__(self):
        self._queue = deque()
    def enqueue(self, request):
        self._queue.append(request)
        print(f"[QUEUE] Added: {request}")
    def dequeue(self):
        if not self._queue:
            print("[QUEUE] No requests in queue.")
            return None
        request = self._queue.popleft()
        print(f"[QUEUE] Processing: {request}")
        return request
    def is_empty(self):
```

Library Book Search System (Queues & Priority Queues)
Scenario
The SRU Library manages book borrow requests. Students and faculty submit requests, but faculty requests must be prioritized over student requests.
Tasks
1. Implement a Queue (FIFO) to manage book requests.
2. Extend the system to a Priority Queue, prioritizing faculty requests.
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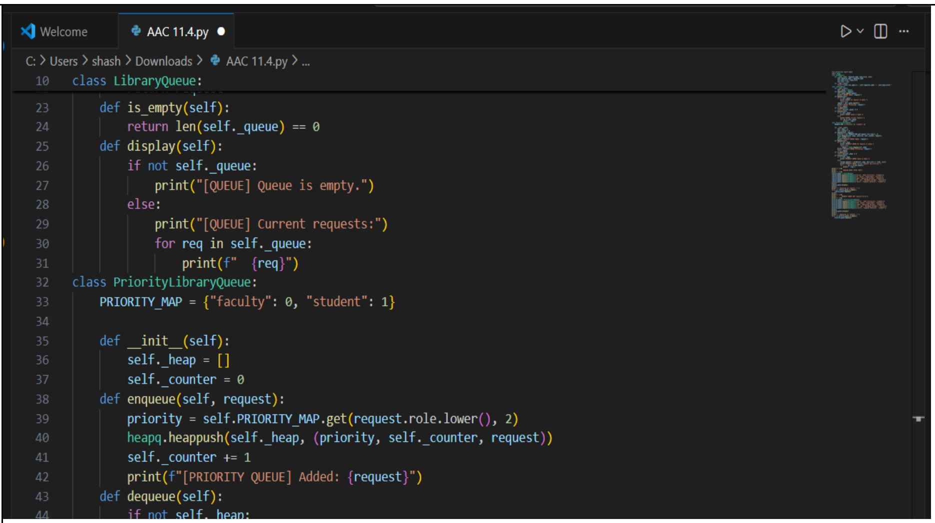
o enqueue() method
o dequeue() method
4. Test the system with a mix of student and faculty requests.
Expected Outcome
• Working queue and priority queue implementations.
• Correct prioritization of faculty requests.
give code in python without comments just paste in the file

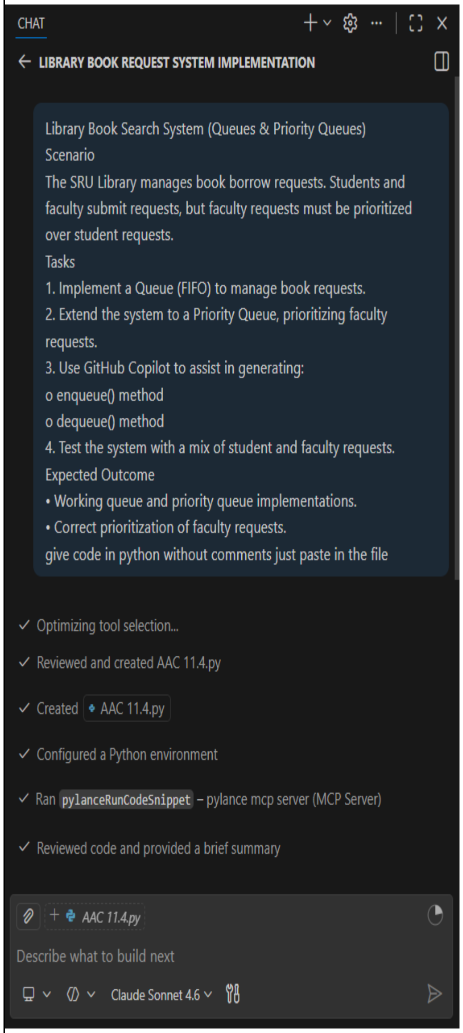
✓ Optimizing tool selection...

✓ Reviewed and created AAC 11.4.py



```python
class LibraryQueue:
    def is_empty(self):
        return len(self._queue) == 0
    def display(self):
        if not self._queue:
            print("[QUEUE] Queue is empty.")
        else:
            print("[QUEUE] Current requests:")
            for req in self._queue:
                print(f"  {req}")
class PriorityLibraryQueue:
    PRIORITY_MAP = {"faculty": 0, "student": 1}

    def __init__(self):
        self._heap = []
        self._counter = 0
    def enqueue(self, request):
        priority = self.PRIORITY_MAP.get(request.role.lower(), 2)
        heapq.heappush(self._heap, (priority, self._counter, request))
        self._counter += 1
        print(f"[PRIORITY QUEUE] Added: {request}")
    def dequeue(self):
        if not self._heap:
```



Library Book Search System (Queues & Priority Queues)
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3. Use GitHub Copilot to assist in generating:
o enqueue() method
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4. Test the system with a mix of student and faculty requests.
Expected Outcome
• Working queue and priority queue implementations.
• Correct prioritization of faculty requests.
give code in python without comments just paste in the file

✓ Optimizing tool selection...

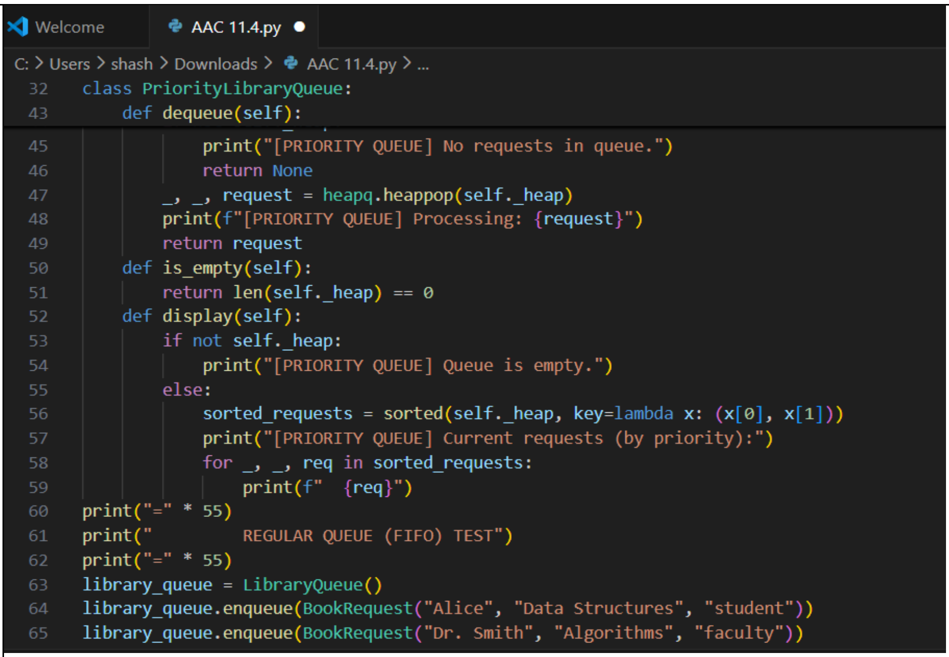
✓ Reviewed and created AAC 11.4.py

✓ Created AAC 11.4.py

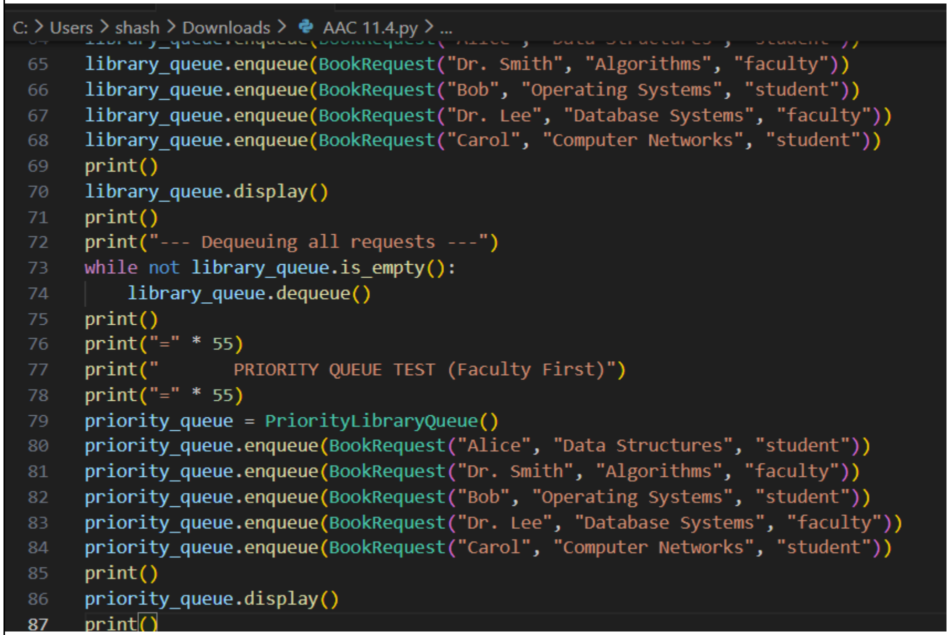
✓ Configured a Python environment

✓ Ran `pylanceRunCodeSnippet` – pylance mcp server (MCP Server)

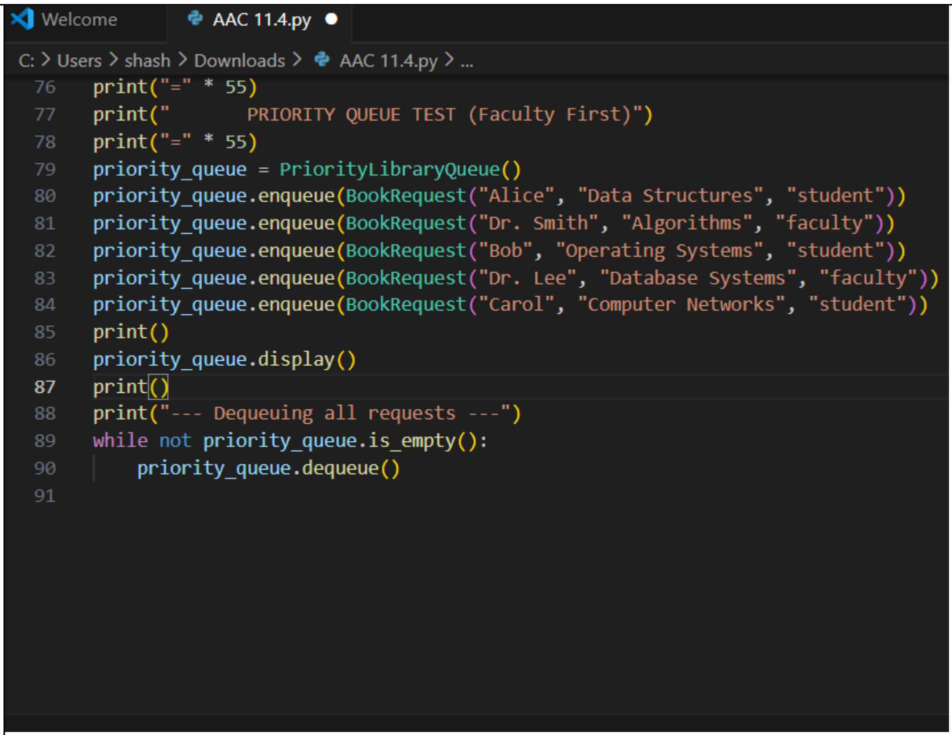
✓ Reviewed code and provided a brief summary



```python
class PriorityLibraryQueue:
    def dequeue(self):
            print("[PRIORITY QUEUE] No requests in queue.")
            return None
        _, _, request = heapq.heappop(self._heap)
        print(f"[PRIORITY QUEUE] Processing: {request}")
        return request
    def is_empty(self):
        return len(self._heap) == 0
    def display(self):
        if not self._heap:
            print("[PRIORITY QUEUE] Queue is empty.")
        else:
            sorted_requests = sorted(self._heap, key=lambda x: (x[0], x[1]))
            print("[PRIORITY QUEUE] Current requests (by priority):")
            for _, _, req in sorted_requests:
                print(f"  {req}")
print("=" * 55)
print("        REGULAR QUEUE (FIFO) TEST")
print("=" * 55)
library_queue = LibraryQueue()
library_queue.enqueue(BookRequest("Alice", "Data Structures", "student"))
library_queue.enqueue(BookRequest("Dr. Smith", "Algorithms", "faculty"))
```



```python
library_queue.enqueue(BookRequest("Dr. Smith", "Algorithms", "faculty"))
library_queue.enqueue(BookRequest("Bob", "Operating Systems", "student"))
library_queue.enqueue(BookRequest("Dr. Lee", "Database Systems", "faculty"))
library_queue.enqueue(BookRequest("Carol", "Computer Networks", "student"))
print()
library_queue.display()
print()
print("--- Dequeuing all requests ---")
while not library_queue.is_empty():
    library_queue.dequeue()
print()
print("=" * 55)
print("       PRIORITY QUEUE TEST (Faculty First)")
print("=" * 55)
priority_queue = PriorityLibraryQueue()
priority_queue.enqueue(BookRequest("Alice", "Data Structures", "student"))
priority_queue.enqueue(BookRequest("Dr. Smith", "Algorithms", "faculty"))
priority_queue.enqueue(BookRequest("Bob", "Operating Systems", "student"))
priority_queue.enqueue(BookRequest("Dr. Lee", "Database Systems", "faculty"))
priority_queue.enqueue(BookRequest("Carol", "Computer Networks", "student"))
print()
priority_queue.display()
print()
```



```python
print("=" * 55)
print("       PRIORITY QUEUE TEST (Faculty First)")
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priority_queue = PriorityLibraryQueue()
priority_queue.enqueue(BookRequest("Alice", "Data Structures", "student"))
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priority_queue.enqueue(BookRequest("Bob", "Operating Systems", "student"))
priority_queue.enqueue(BookRequest("Dr. Lee", "Database Systems", "faculty"))
priority_queue.enqueue(BookRequest("Carol", "Computer Networks", "student"))
print()
priority_queue.display()
print()
print("--- Dequeuing all requests ---")
while not priority_queue.is_empty():
    priority_queue.dequeue()
```

Task 3: Emergency Help Desk (Stack Implementation)

Scenario

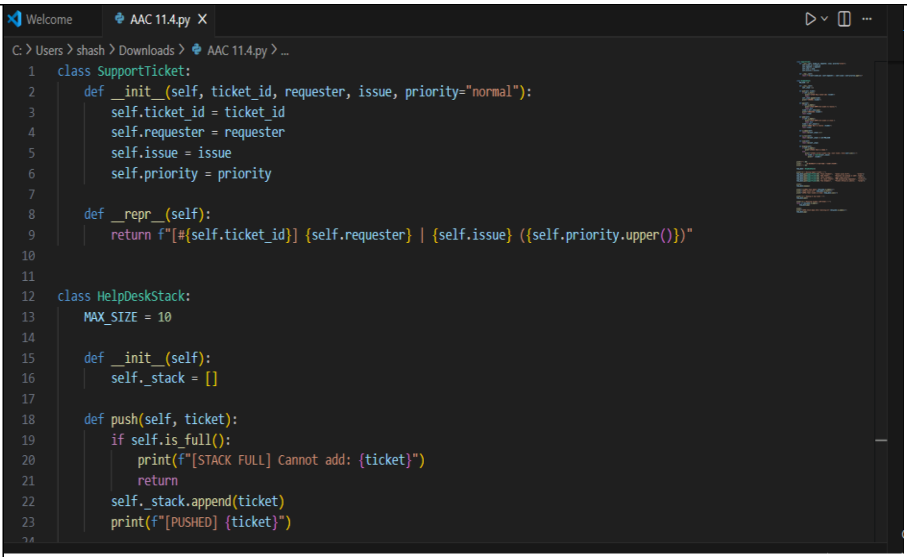
SR University's IT Help Desk receives technical support tickets from students and staff. While tickets are received sequentially, issue escalation follows a **Last-In, First-Out (LIFO)** approach.

Tasks

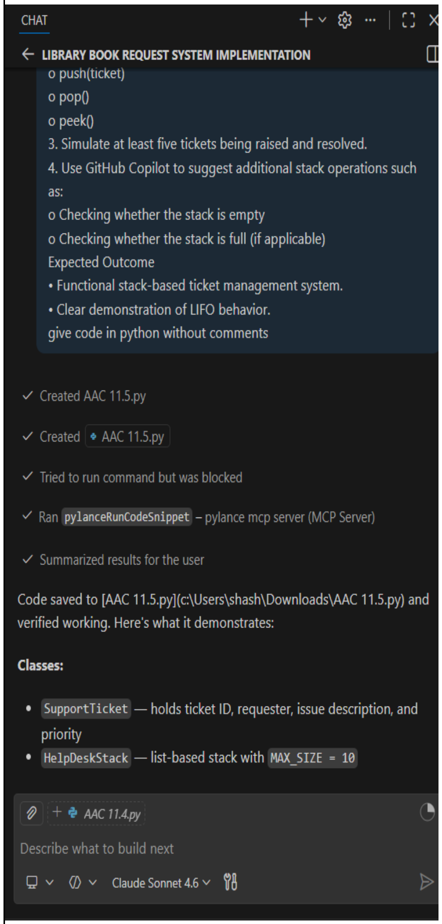
1. Implement a **Stack** to manage support tickets.
2. Provide the following operations:
   - push(ticket)
   - pop()
   - peek()
3. Simulate at least **five tickets** being raised and resolved.
4. Use **GitHub Copilot** to suggest additional stack operations such as:
   - Checking whether the stack is empty
   - Checking whether the stack is full (if applicable)

Expected Outcome

- Functional stack-based ticket management system.
- Clear demonstration of LIFO behavior.



```python
class SupportTicket:
    def __init__(self, ticket_id, requester, issue, priority="normal"):
        self.ticket_id = ticket_id
        self.requester = requester
        self.issue = issue
        self.priority = priority

    def __repr__(self):
        return f"[#{self.ticket_id}] {self.requester} | {self.issue} ({self.priority.upper()})"


class HelpDeskStack:
    MAX_SIZE = 10

    def __init__(self):
        self._stack = []

    def push(self, ticket):
        if self.is_full():
            print(f"[STACK FULL] Cannot add: {ticket}")
            return
        self._stack.append(ticket)
        print(f"[PUSHED] {ticket}")
```



o push(ticket)
o pop()
o peek()
3. Simulate at least five tickets being raised and resolved.
4. Use GitHub Copilot to suggest additional stack operations such as:
o Checking whether the stack is empty
o Checking whether the stack is full (if applicable)
Expected Outcome
• Functional stack-based ticket management system.
• Clear demonstration of LIFO behavior.
give code in python without comments

✓ Created AAC 11.5.py

✓ Created AAC 11.5.py

✓ Tried to run command but was blocked

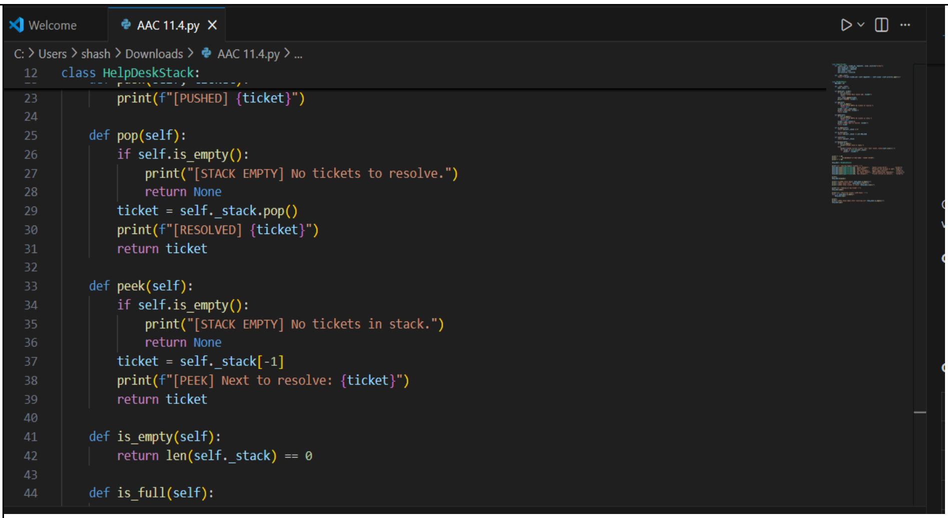
✓ Ran `pylanceRunCodeSnippet` – pylance mcp server (MCP Server)

✓ Summarized results for the user

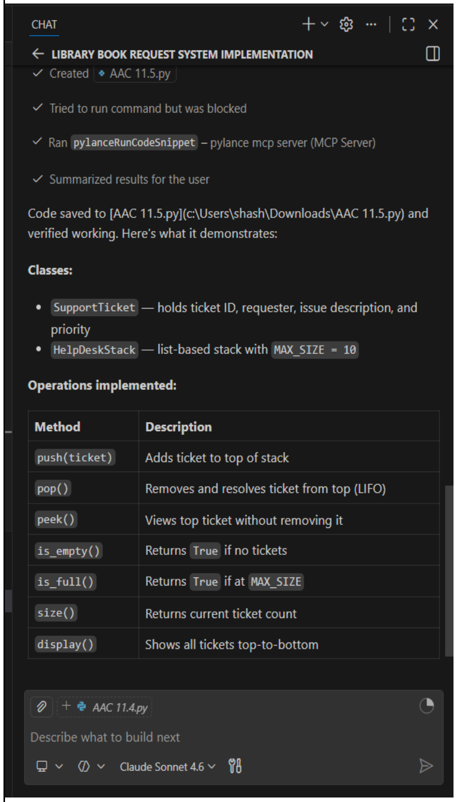
Code saved to [AAC 11.5.py](c:\Users\shash\Downloads\AAC 11.5.py) and verified working. Here's what it demonstrates:

Classes:

- `SupportTicket` — holds ticket ID, requester, issue description, and priority
- `HelpDeskStack` — list-based stack with `MAX_SIZE = 10`



```
class HelpDeskStack:
        print(f"[PUSHED] {ticket}")

    def pop(self):
        if self.is_empty():
            print("[STACK EMPTY] No tickets to resolve.")
            return None
        ticket = self._stack.pop()
        print(f"[RESOLVED] {ticket}")
        return ticket

    def peek(self):
        if self.is_empty():
            print("[STACK EMPTY] No tickets in stack.")
            return None
        ticket = self._stack[-1]
        print(f"[PEEK] Next to resolve: {ticket}")
        return ticket

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

    def is_full(self):
```



✓ Created AAC 11.5.py

✓ Tried to run command but was blocked

✓ Ran `pylanceRunCodeSnippet` – pylance mcp server (MCP Server)

✓ Summarized results for the user

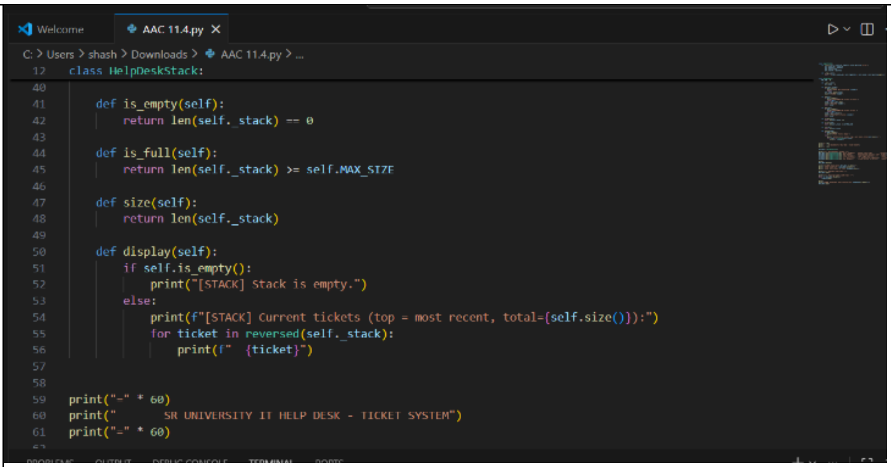
Code saved to [AAC 11.5.py](c:\Users\shash\Downloads\AAC 11.5.py) and verified working. Here's what it demonstrates:

Classes:

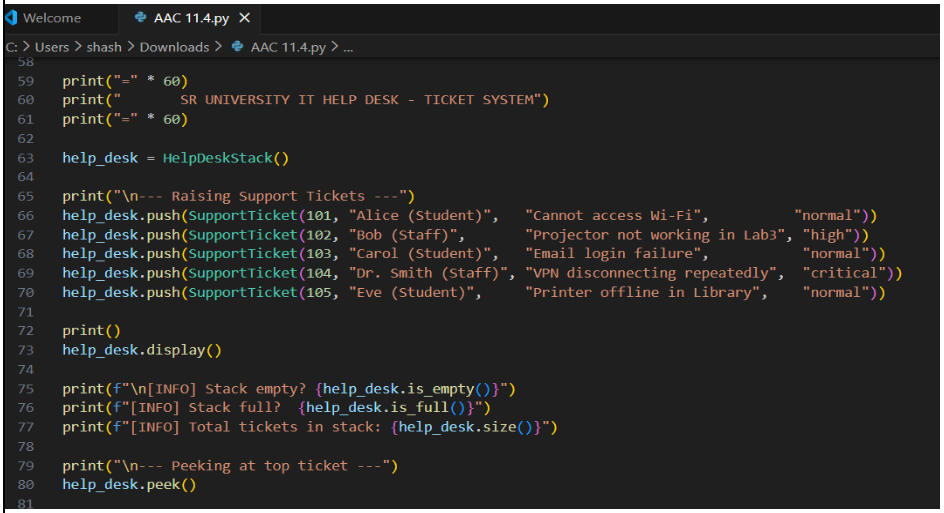
- `SupportTicket` — holds ticket ID, requester, issue description, and priority
- `HelpDeskStack` — list-based stack with `MAX_SIZE = 10`

Operations implemented:

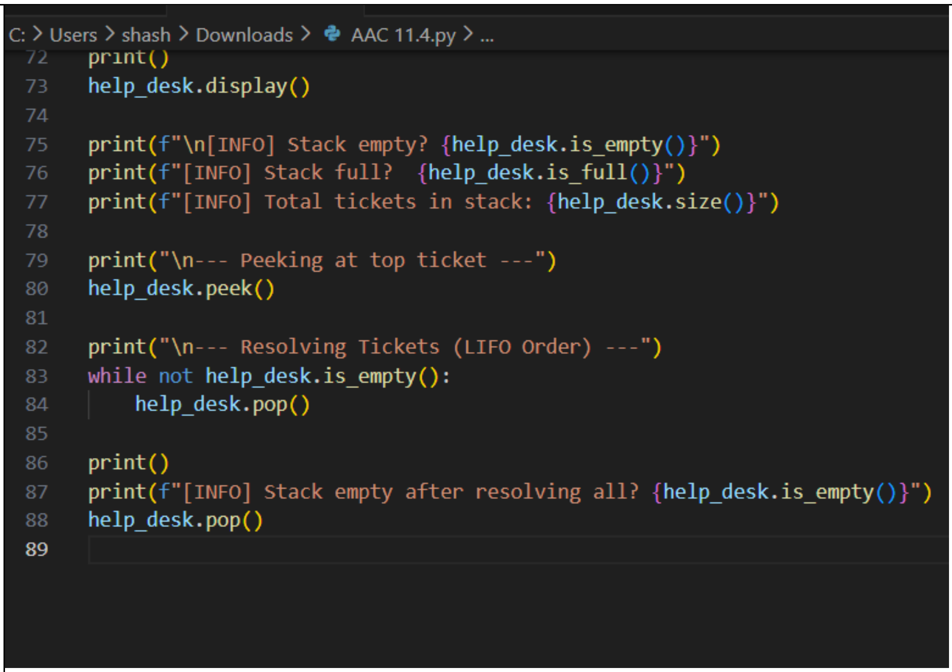
Method	Description
`push(ticket)`	Adds ticket to top of stack
`pop()`	Removes and resolves ticket from top (LIFO)
`peek()`	Views top ticket without removing it
`is_empty()`	Returns `True` if no tickets
`is_full()`	Returns `True` if at `MAX_SIZE`
`size()`	Returns current ticket count
`display()`	Shows all tickets top-to-bottom



```python
class HelpDeskStack:

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

    def is_full(self):
        return len(self._stack) >= self.MAX_SIZE

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

    def display(self):
        if self.is_empty():
            print("[STACK] Stack is empty.")
        else:
            print(f"[STACK] Current tickets (top = most recent, total={self.size()}):")
            for ticket in reversed(self._stack):
                print(f"  {ticket}")


print("=" * 60)
print("       SR UNIVERSITY IT HELP DESK - TICKET SYSTEM")
print("=" * 60)
```



```python
print("=" * 60)
print("       SR UNIVERSITY IT HELP DESK - TICKET SYSTEM")
print("=" * 60)

help_desk = HelpDeskStack()

print("\n--- Raising Support Tickets ---")
help_desk.push(SupportTicket(101, "Alice (Student)",   "Cannot access Wi-Fi",           "normal"))
help_desk.push(SupportTicket(102, "Bob (Staff)",       "Projector not working in Lab3", "high"))
help_desk.push(SupportTicket(103, "Carol (Student)",   "Email login failure",           "normal"))
help_desk.push(SupportTicket(104, "Dr. Smith (Staff)", "VPN disconnecting repeatedly",  "critical"))
help_desk.push(SupportTicket(105, "Eve (Student)",     "Printer offline in Library",    "normal"))

print()
help_desk.display()

print(f"\n[INFO] Stack empty? {help_desk.is_empty()}")
print(f"[INFO] Stack full?  {help_desk.is_full()}")
print(f"[INFO] Total tickets in stack: {help_desk.size()}")

print("\n--- Peeking at top ticket ---")
help_desk.peek()
```



```python
print()
help_desk.display()

print(f"\n[INFO] Stack empty? {help_desk.is_empty()}")
print(f"[INFO] Stack full?  {help_desk.is_full()}")
print(f"[INFO] Total tickets in stack: {help_desk.size()}")

print("\n--- Peeking at top ticket ---")
help_desk.peek()

print("\n--- Resolving Tickets (LIFO Order) ---")
while not help_desk.is_empty():
    help_desk.pop()

print()
print(f"[INFO] Stack empty after resolving all? {help_desk.is_empty()}")
help_desk.pop()
```

Task 4: Hash Table

Objective

To implement a **Hash Table** and understand collision handling.

Task Description

Use AI to generate a hash table with:

- Insert
- Search
- Delete

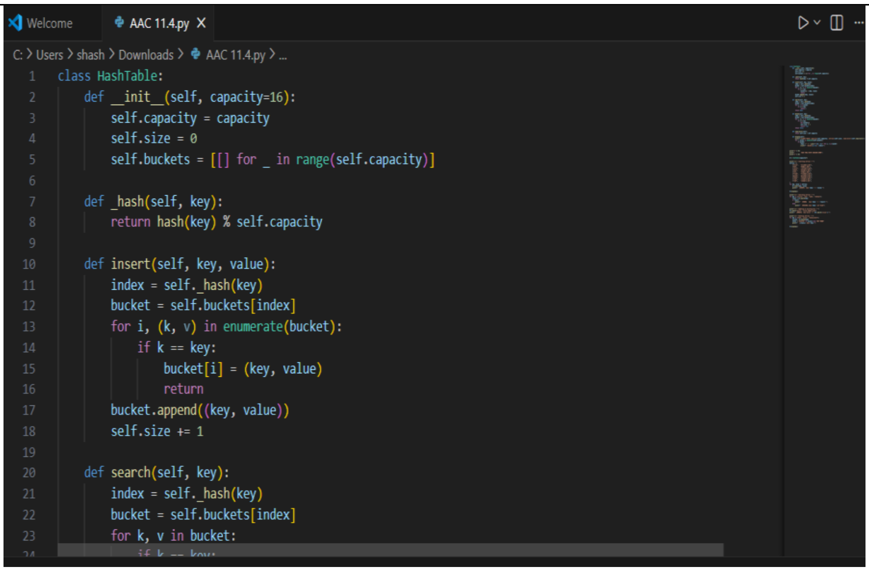
Starter Code

class HashTable:

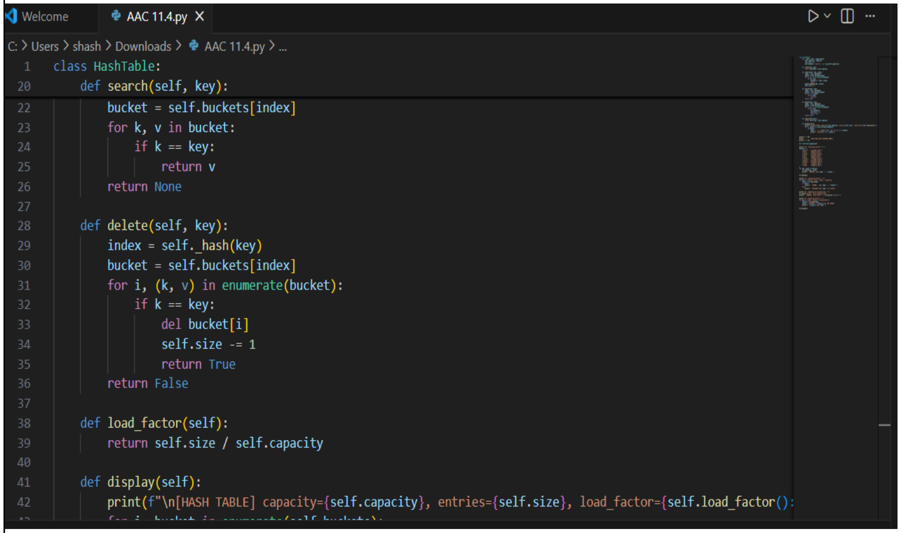
pass

Expected Outcome

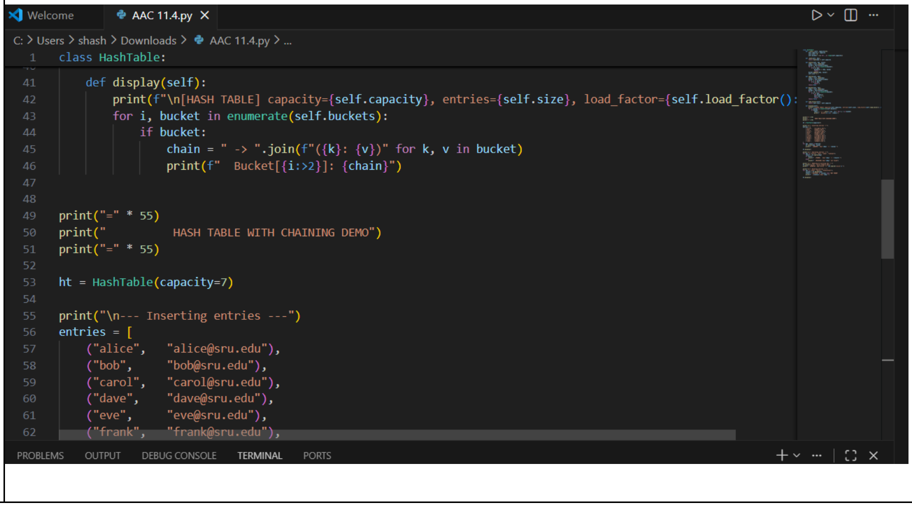
- Collision handling using chaining
- Well-commented methods



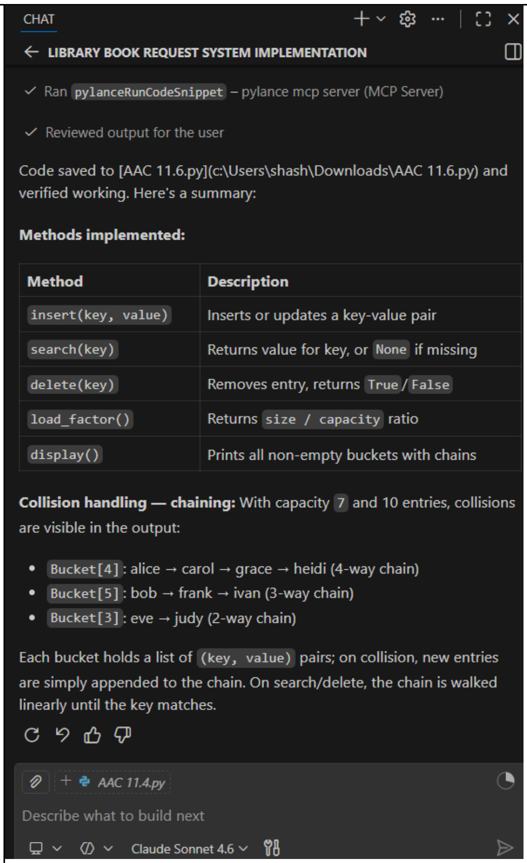
```python
class HashTable:
    def __init__(self, capacity=16):
        self.capacity = capacity
        self.size = 0
        self.buckets = [[] for _ in range(self.capacity)]

    def _hash(self, key):
        return hash(key) % self.capacity

    def insert(self, key, value):
        index = self._hash(key)
        bucket = self.buckets[index]
        for i, (k, v) in enumerate(bucket):
            if k == key:
                bucket[i] = (key, value)
                return
        bucket.append((key, value))
        self.size += 1

    def search(self, key):
        index = self._hash(key)
        bucket = self.buckets[index]
        for k, v in bucket:
```



```python
class HashTable:
    def search(self, key):
        bucket = self.buckets[index]
        for k, v in bucket:
            if k == key:
                return v
        return None

    def delete(self, key):
        index = self._hash(key)
        bucket = self.buckets[index]
        for i, (k, v) in enumerate(bucket):
            if k == key:
                del bucket[i]
                self.size -= 1
                return True
        return False

    def load_factor(self):
        return self.size / self.capacity

    def display(self):
        print(f"\n[HASH TABLE] capacity={self.capacity}, entries={self.size}, load_factor={self.load_factor():
```



```python
class HashTable:
    def display(self):
        print(f"\n[HASH TABLE] capacity={self.capacity}, entries={self.size}, load_factor={self.load_factor():
        for i, bucket in enumerate(self.buckets):
            if bucket:
                chain = " -> ".join(f"({k}: {v})" for k, v in bucket)
                print(f"  Bucket[{i:>2}]: {chain}")


print("=" * 55)
print("          HASH TABLE WITH CHAINING DEMO")
print("=" * 55)

ht = HashTable(capacity=7)

print("\n--- Inserting entries ---")
entries = [
    ("alice",   "alice@sru.edu"),
    ("bob",     "bob@sru.edu"),
    ("carol",   "carol@sru.edu"),
    ("dave",    "dave@sru.edu"),
    ("eve",     "eve@sru.edu"),
    ("frank",   "frank@sru.edu"),
```



✓ Ran `pylanceRunCodeSnippet` – pylance mcp server (MCP Server)

✓ Reviewed output for the user

Code saved to [AAC 11.6.py](c:\Users\shash\Downloads\AAC 11.6.py) and verified working. Here's a summary:

Methods implemented:

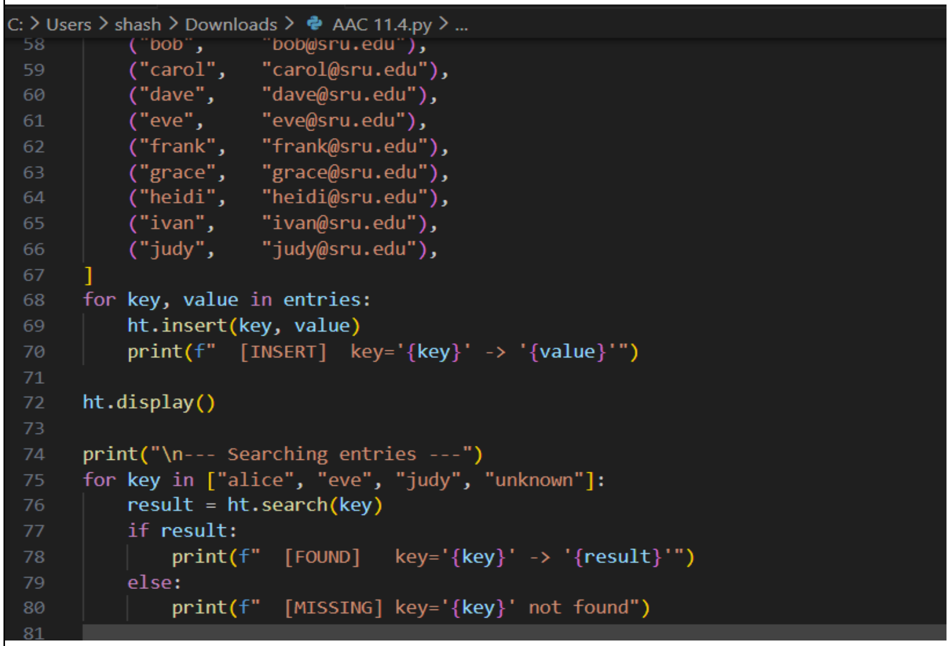
Method	Description
`insert(key, value)`	Inserts or updates a key-value pair
`search(key)`	Returns value for key, or `None` if missing
`delete(key)`	Removes entry, returns `True`/`False`
`load_factor()`	Returns `size / capacity` ratio
`display()`	Prints all non-empty buckets with chains

Collision handling — chaining: With capacity `7` and 10 entries, collisions are visible in the output:

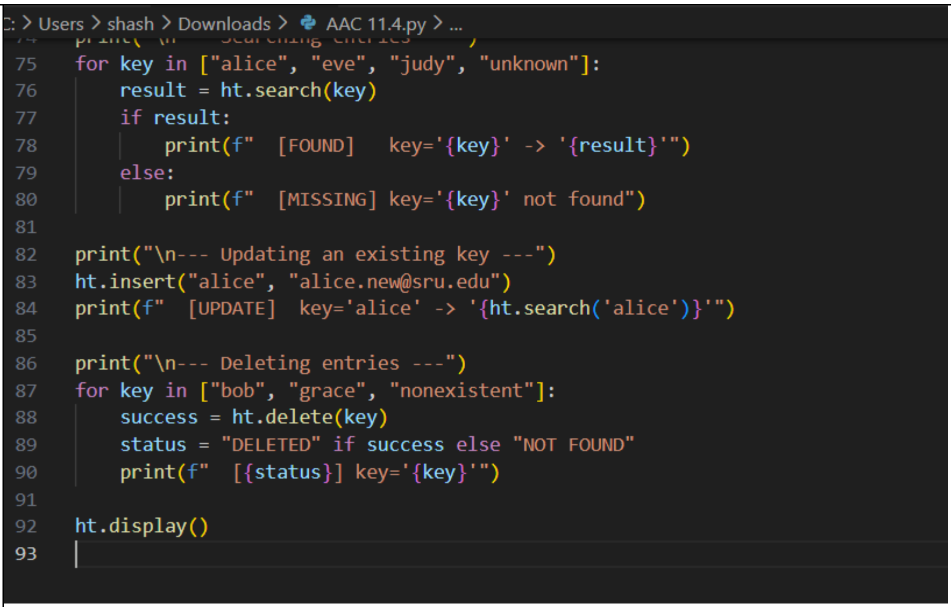
- `Bucket[4]`: alice → carol → grace → heidi (4-way chain)
- `Bucket[5]`: bob → frank → ivan (3-way chain)
- `Bucket[3]`: eve → judy (2-way chain)

Each bucket holds a list of `(key, value)` pairs; on collision, new entries are simply appended to the chain. On search/delete, the chain is walked linearly until the key matches.

AAC 11.4.py
Describe what to build next
Claude Sonnet 4.6


C: > Users > shash > Downloads > AAC 11.4.py > ...

```
        ("bob",     "bob@sru.edu"),
        ("carol",   "carol@sru.edu"),
        ("dave",    "dave@sru.edu"),
        ("eve",     "eve@sru.edu"),
        ("frank",   "frank@sru.edu"),
        ("grace",   "grace@sru.edu"),
        ("heidi",   "heidi@sru.edu"),
        ("ivan",    "ivan@sru.edu"),
        ("judy",    "judy@sru.edu"),
    ]
    for key, value in entries:
        ht.insert(key, value)
        print(f"  [INSERT]  key='{key}' -> '{value}'")

    ht.display()

    print("\n--- Searching entries ---")
    for key in ["alice", "eve", "judy", "unknown"]:
        result = ht.search(key)
        if result:
            print(f"  [FOUND]   key='{key}' -> '{result}'")
        else:
            print(f"  [MISSING] key='{key}' not found")

```



```python
for key in ["alice", "eve", "judy", "unknown"]:
    result = ht.search(key)
    if result:
        print(f"  [FOUND]   key='{key}' -> '{result}'")
    else:
        print(f"  [MISSING] key='{key}' not found")

print("\n--- Updating an existing key ---")
ht.insert("alice", "alice.new@sru.edu")
print(f"  [UPDATE]  key='alice' -> '{ht.search('alice')}'")

print("\n--- Deleting entries ---")
for key in ["bob", "grace", "nonexistent"]:
    success = ht.delete(key)
    status = "DELETED" if success else "NOT FOUND"
    print(f"  [{status}] key='{key}'")

ht.display()
```

Task 5: Real-Time Application Challenge

Scenario

Design a **Campus Resource Management System** with the following features:

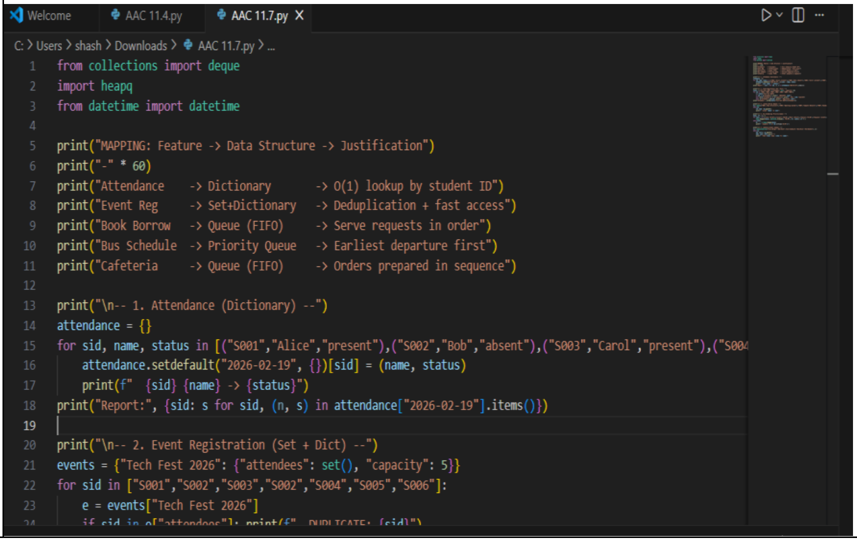
- Student Attendance Tracking
- Event Registration System
- Library Book Borrowing
- Bus Scheduling System
- Cafeteria Order Queue

Student Tasks

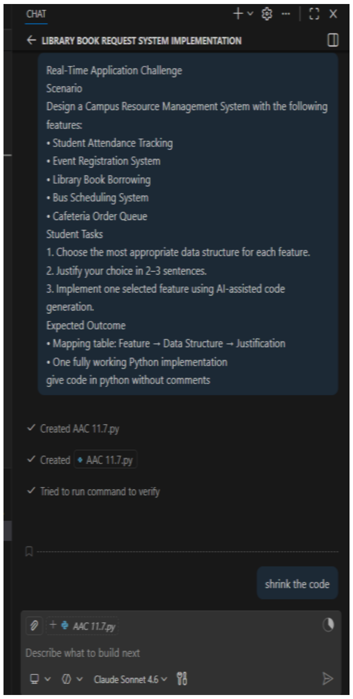
1. Choose the most appropriate data structure for each feature.
2. Justify your choice in **2–3 sentences**.
3. Implement **one selected feature** using AI-assisted code generation.

Expected Outcome

- Mapping table: Feature → Data Structure → Justification
- One fully working Python implementation



```python
from collections import deque
import heapq
from datetime import datetime

print("MAPPING: Feature -> Data Structure -> Justification")
print("-" * 60)
print("Attendance    -> Dictionary      -> O(1) lookup by student ID")
print("Event Reg     -> Set+Dictionary  -> Deduplication + fast access")
print("Book Borrow   -> Queue (FIFO)    -> Serve requests in order")
print("Bus Schedule  -> Priority Queue  -> Earliest departure first")
print("Cafeteria     -> Queue (FIFO)    -> Orders prepared in sequence")

print("\n-- 1. Attendance (Dictionary) --")
attendance = {}
for sid, name, status in [("S001","Alice","present"),("S002","Bob","absent"),("S003","Carol","present"),("S004
    attendance.setdefault("2026-02-19", {})[sid] = (name, status)
    print(f"  {sid} {name} -> {status}")
print("Report:", {sid: s for sid, (n, s) in attendance["2026-02-19"].items()})

print("\n-- 2. Event Registration (Set + Dict) --")
events = {"Tech Fest 2026": {"attendees": set(), "capacity": 5}}
for sid in ["S001","S002","S003","S002","S004","S005","S006"]:
    e = events["Tech Fest 2026"]
```



Real-Time Application Challenge
Scenario
Design a Campus Resource Management System with the following features:
- Student Attendance Tracking
- Event Registration System
- Library Book Borrowing
- Bus Scheduling System
- Cafeteria Order Queue

Student Tasks
1. Choose the most appropriate data structure for each feature.
2. Justify your choice in 2–3 sentences.
3. Implement one selected feature using AI-assisted code generation.

Expected Outcome
- Mapping table: Feature → Data Structure → Justification
- One fully working Python implementation

give code in python without comments

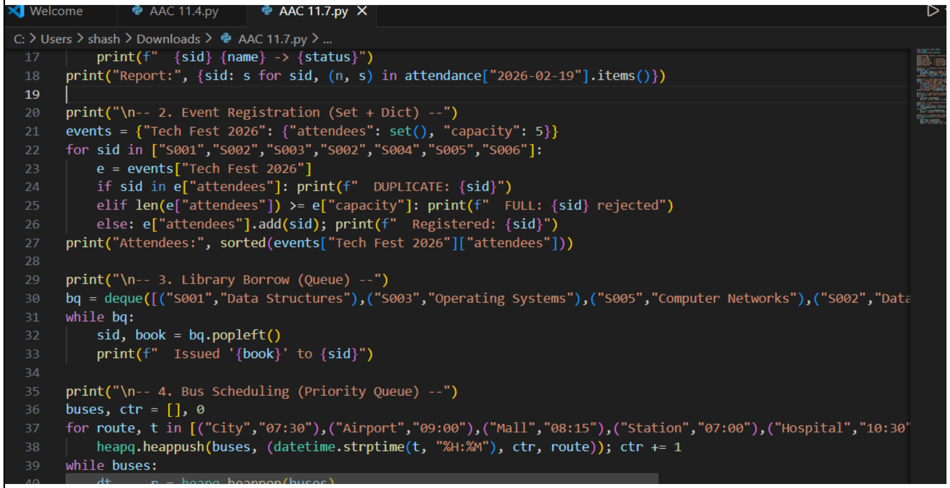
✓ Created AAC 11.7.py

✓ Created AAC 11.7.py

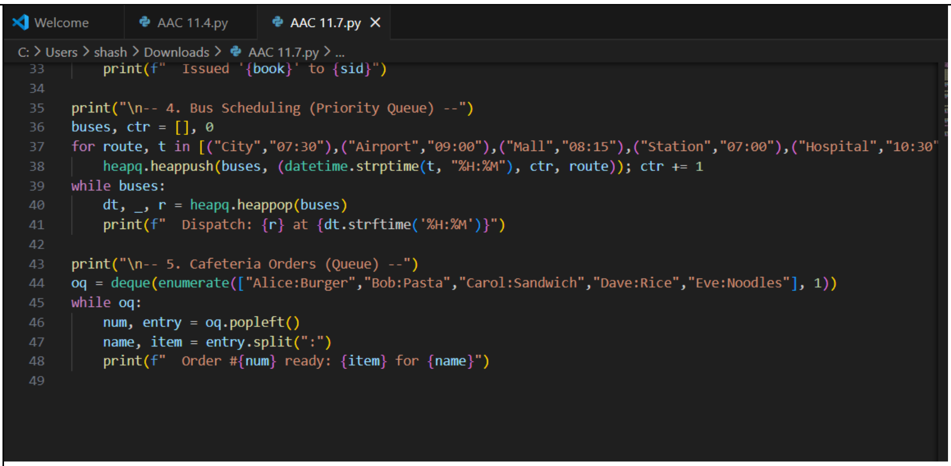
✓ Tried to run command to verify

shrink the code

AAC 11.7.py
Describe what to build next
Claude Sonnet 4.6


Welcome
AAC 11.4.py
AAC 11.7.py
C: > Users > shash > Downloads > AAC 11.7.py > ...

```python
    print(f"  {sid} {name} -> {status}")
print("Report:", {sid: s for sid, (n, s) in attendance["2026-02-19"].items()})

print("\n-- 2. Event Registration (Set + Dict) --")
events = {"Tech Fest 2026": {"attendees": set(), "capacity": 5}}
for sid in ["S001","S002","S003","S002","S004","S005","S006"]:
    e = events["Tech Fest 2026"]
    if sid in e["attendees"]: print(f"  DUPLICATE: {sid}")
    elif len(e["attendees"]) >= e["capacity"]: print(f"  FULL: {sid} rejected")
    else: e["attendees"].add(sid); print(f"  Registered: {sid}")
print("Attendees:", sorted(events["Tech Fest 2026"]["attendees"]))

print("\n-- 3. Library Borrow (Queue) --")
bq = deque([("S001","Data Structures"),("S003","Operating Systems"),("S005","Computer Networks"),("S002","Data
while bq:
    sid, book = bq.popleft()
    print(f"  Issued '{book}' to {sid}")

print("\n-- 4. Bus Scheduling (Priority Queue) --")
buses, ctr = [], 0
for route, t in [("City","07:30"),("Airport","09:00"),("Mall","08:15"),("Station","07:00"),("Hospital","10:30"
    heapq.heappush(buses, (datetime.strptime(t, "%H:%M"), ctr, route)); ctr += 1
while buses:
```



```python
    print(f"  Issued '{book}' to {sid}")

print("\n-- 4. Bus Scheduling (Priority Queue) --")
buses, ctr = [], 0
for route, t in [("City","07:30"),("Airport","09:00"),("Mall","08:15"),("Station","07:00"),("Hospital","10:30"
    heapq.heappush(buses, (datetime.strptime(t, "%H:%M"), ctr, route)); ctr += 1
while buses:
    dt, _, r = heapq.heappop(buses)
    print(f"  Dispatch: {r} at {dt.strftime('%H:%M')}")

print("\n-- 5. Cafeteria Orders (Queue) --")
oq = deque(enumerate(["Alice:Burger","Bob:Pasta","Carol:Sandwich","Dave:Rice","Eve:Noodles"], 1))
while oq:
    num, entry = oq.popleft()
    name, item = entry.split(":")
    print(f"  Order #{num} ready: {item} for {name}")
```

Note: Report should be submitted as a word document for all tasks in a single document with prompts, comments & code explanation, and output and if required, screenshots.

2303A51504

Batch:25

Task 1: AI-Assisted Syntax and Code Quality Review

Scenario

You join a development team and are asked to review a junior developer's Python script that fails to run correctly due to basic coding mistakes. Before deployment, the code must be corrected and standardized.

Task Description

You are given a Python script containing:

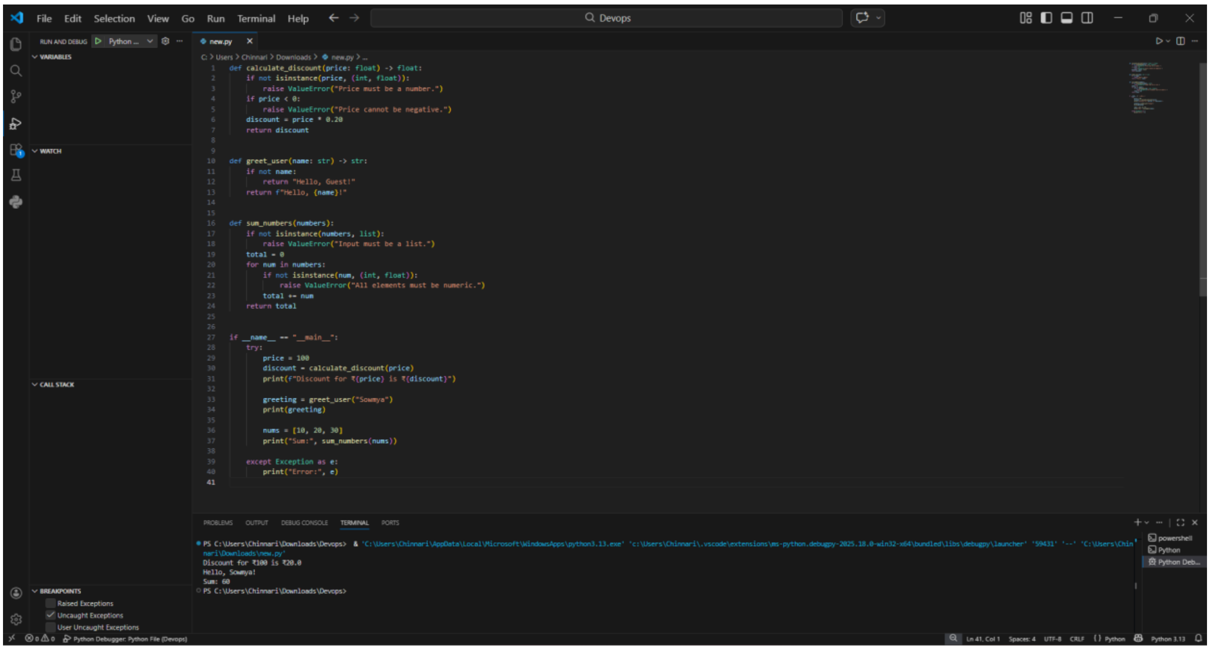
- Syntax errors
- Indentation issues
- Incorrect variable names
- Faulty function calls

Use an AI tool (GitHub Copilot / Cursor AI) to:

- Identify all syntactic and structural errors
- Correct them systematically
- Generate an explanation of each fix made

Expected Outcome

- Fully corrected and executable Python code
- AI-generated explanation describing:
  - o Syntax fixes
  - o Naming corrections
  - o Structural improvements
- Clean, readable version of the script



```python
def calculate_discount(price: float) -> float:
    if not isinstance(price, (int, float)):
        raise ValueError("Price must be a number.")
    if price < 0:
        raise ValueError("Price cannot be negative.")
    discount = price * 0.20
    return discount


def greet_user(name: str) -> str:
    if not name:
        return "Hello, Guest!"
    return f"Hello, {name}!"


def sum_numbers(numbers):
    if not isinstance(numbers, list):
        raise ValueError("Input must be a list.")
    total = 0
    for num in numbers:
        if not isinstance(num, (int, float)):
            raise ValueError("All elements must be numeric.")
        total += num
    return total


if __name__ == "__main__":
    try:
        price = 100
        discount = calculate_discount(price)
        print(f"Discount for ₹{price} is ₹{discount}")

        greeting = greet_user("Sowmya")
        print(greeting)

        nums = [10, 20, 30]
        print("Sum:", sum_numbers(nums))

    except Exception as e:
        print("Error:", e)

```

```
PS C:\Users\Chinnari\Downloads\Devops>  & 'C:\Users\Chinnari\AppData\Local\Microsoft\WindowsApps\python3.13.exe' 'c:\Users\Chinnari\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '59431' '--' 'C:\Users\Chin
nari\Downloads\new.py'
Discount for ₹100 is ₹20.0
Hello, Sowmya!
Sum: 60
PS C:\Users\Chinnari\Downloads\Devops>
```

Task 2: Performance-Oriented Code Review

Scenario

A data processing function works correctly but is inefficient and slows down the system when large datasets are used.

Task Description

You are provided with a function that identifies duplicate values in a list using inefficient nested loops.

Using AI-assisted code review:

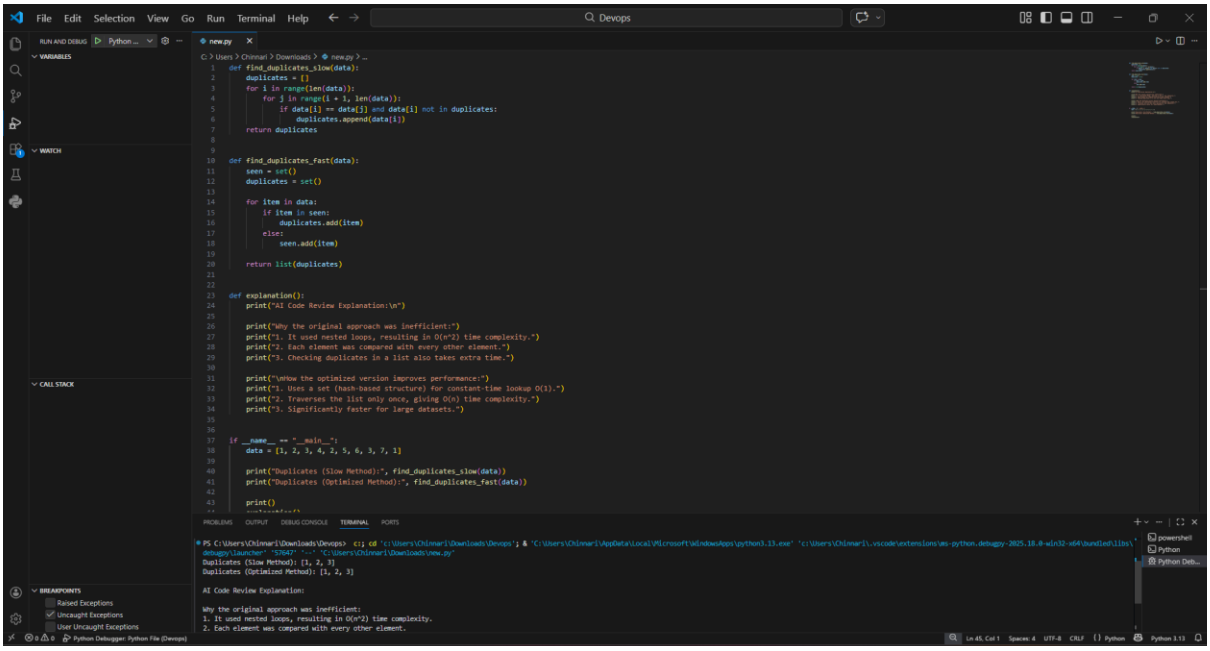
- Analyze the logic for performance bottlenecks
- Refactor the code for better time complexity
- Preserve the correctness of the output

Ask the AI to explain:

- Why the original approach was inefficient
- How the optimized version improves performance

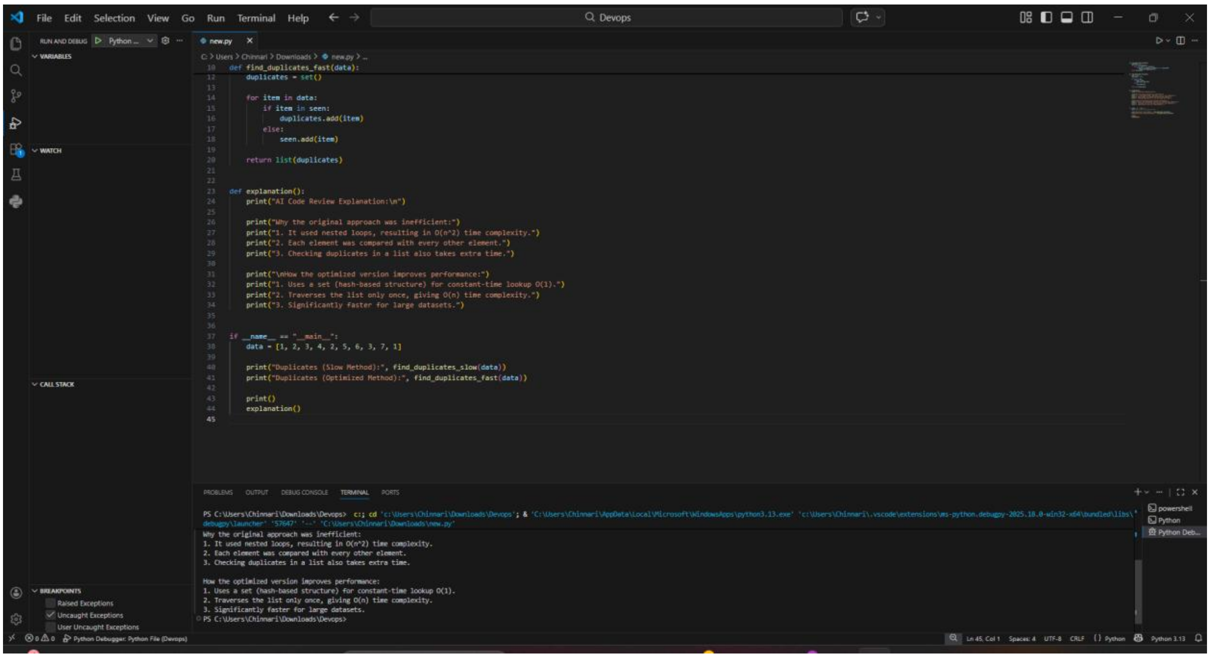
Expected Outcome

- Optimized duplicate-detection logic (e.g., using sets or hash-based structures)
- Improved time complexity
- AI explanation of performance improvement
- Clean, readable implementation



```python
def find_duplicates_slow(data):
    duplicates = []
    for i in range(len(data)):
        for j in range(i + 1, len(data)):
            if data[i] == data[j] and data[i] not in duplicates:
                duplicates.append(data[i])
    return duplicates


def find_duplicates_fast(data):
    seen = set()
    duplicates = set()

    for item in data:
        if item in seen:
            duplicates.add(item)
        else:
            seen.add(item)

    return list(duplicates)


def explanation():
    print("AI Code Review Explanation:\n")

    print("Why the original approach was inefficient:")
    print("1. It used nested loops, resulting in O(n^2) time complexity.")
    print("2. Each element was compared with every other element.")
    print("3. Checking duplicates in a list also takes extra time.")

    print("\nHow the optimized version improves performance:")
    print("1. Uses a set (hash-based structure) for constant-time lookup O(1).")
    print("2. Traverses the list only once, giving O(n) time complexity.")
    print("3. Significantly faster for large datasets.")


if __name__ == "__main__":
    data = [1, 2, 3, 4, 2, 5, 6, 3, 7, 1]

    print("Duplicates (Slow Method):", find_duplicates_slow(data))
    print("Duplicates (Optimized Method):", find_duplicates_fast(data))

    print()
```

```
PS C:\Users\Chinnari\Downloads\Devops>  c:; cd 'c:\Users\Chinnari\Downloads\Devops'; & 'C:\Users\Chinnari\AppData\Local\Microsoft\WindowsApps\python3.13.exe' 'c:\Users\Chinnari\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '57647' '--' 'C:\Users\Chinnari\Downloads\new.py'
Duplicates (Slow Method): [1, 2, 3]
Duplicates (Optimized Method): [1, 2, 3]

AI Code Review Explanation:

Why the original approach was inefficient:
1. It used nested loops, resulting in O(n^2) time complexity.
2. Each element was compared with every other element.
```



```python
def find_duplicates_fast(data):
    duplicates = set()

    for item in data:
        if item in seen:
            duplicates.add(item)
        else:
            seen.add(item)

    return list(duplicates)


def explanation():
    print("AI Code Review Explanation:\n")

    print("Why the original approach was inefficient:")
    print("1. It used nested loops, resulting in O(n^2) time complexity.")
    print("2. Each element was compared with every other element.")
    print("3. Checking duplicates in a list also takes extra time.")

    print("\nHow the optimized version improves performance:")
    print("1. Uses a set (hash-based structure) for constant-time lookup O(1).")
    print("2. Traverses the list only once, giving O(n) time complexity.")
    print("3. Significantly faster for large datasets.")


if __name__ == "__main__":
    data = [1, 2, 3, 4, 2, 5, 6, 3, 7, 1]

    print("Duplicates (Slow Method):", find_duplicates_slow(data))
    print("Duplicates (Optimized Method):", find_duplicates_fast(data))

    print()
    explanation()
```

```
PS C:\Users\Chinnari\Downloads\Devops>  c:; cd 'c:\Users\Chinnari\Downloads\Devops'; & 'C:\Users\Chinnari\AppData\Local\Microsoft\WindowsApps\python3.13.exe' 'c:\Users\Chinnari\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '57647' '--' 'C:\Users\Chinnari\Downloads\new.py'
Why the original approach was inefficient:
1. It used nested loops, resulting in O(n^2) time complexity.
2. Each element was compared with every other element.
3. Checking duplicates in a list also takes extra time.

How the optimized version improves performance:
1. Uses a set (hash-based structure) for constant-time lookup O(1).
2. Traverses the list only once, giving O(n) time complexity.
3. Significantly faster for large datasets.
PS C:\Users\Chinnari\Downloads\Devops>
```

Task 3: Readability and Maintainability Refactoring

Scenario

A working script exists in a project, but it is difficult to understand due to poor naming, formatting, and structure. The team wants it rewritten for long-term maintainability.

Task Description

You are given a poorly structured Python function with:

- Cryptic function names
- Poor indentation

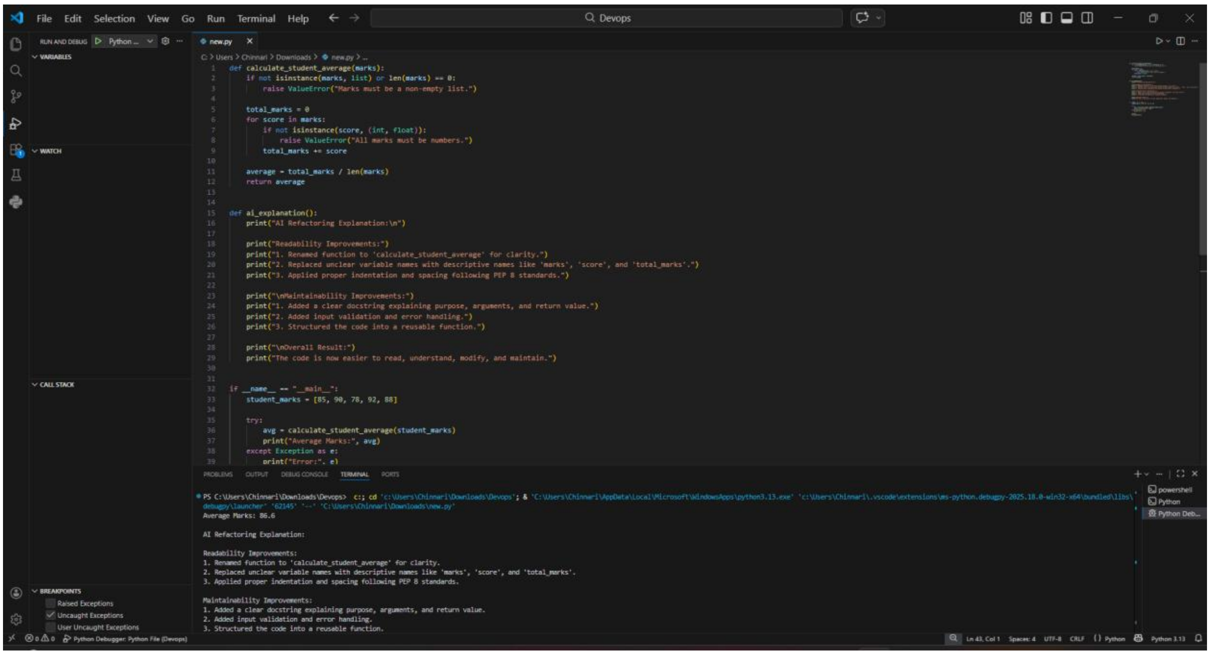
- Unclear variable naming
- No documentation

Use AI-assisted review to:

- Refactor the code for clarity
- Apply PEP 8 formatting standards
- Improve naming conventions
- Add meaningful documentation

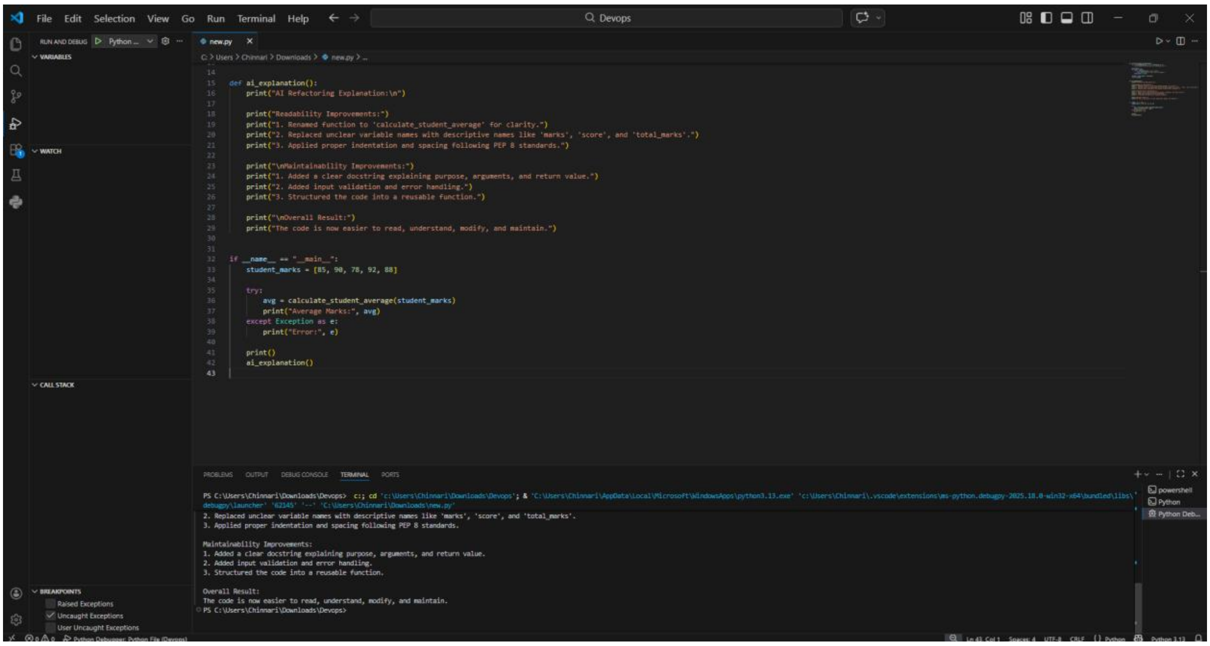
Expected Outcome

- Clean, well-structured code
- Descriptive function and variable names
- Proper indentation and formatting
- Docstrings explaining the function purpose
- AI explanation of readability improvements


File Edit Selection View Go Run Terminal Help
Devops
RUN AND DEBUG
VARIABLES
WATCH
CALL STACK
BREAKPOINTS
Raised Exceptions
Uncaught Exceptions
User Uncaught Exceptions
new.py
C: > Users > Chinnari > Downloads > new.py > ...
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
powershell
Python
Python Deb...
Python Debugger: Python File (Devops)
Ln 43, Col 1 Spaces: 4 UTF-8 CRLF {} Python Python 3.13

```python
def calculate_student_average(marks):
    if not isinstance(marks, list) or len(marks) == 0:
        raise ValueError("Marks must be a non-empty list.")

    total_marks = 0
    for score in marks:
        if not isinstance(score, (int, float)):
            raise ValueError("All marks must be numbers.")
        total_marks += score

    average = total_marks / len(marks)
    return average


def ai_explanation():
    print("AI Refactoring Explanation:\n")

    print("Readability Improvements:")
    print("1. Renamed function to 'calculate_student_average' for clarity.")
    print("2. Replaced unclear variable names with descriptive names like 'marks', 'score', and 'total_marks'.")
    print("3. Applied proper indentation and spacing following PEP 8 standards.")

    print("\nMaintainability Improvements:")
    print("1. Added a clear docstring explaining purpose, arguments, and return value.")
    print("2. Added input validation and error handling.")
    print("3. Structured the code into a reusable function.")

    print("\nOverall Result:")
    print("The code is now easier to read, understand, modify, and maintain.")


if __name__ == "__main__":
    student_marks = [85, 90, 78, 92, 88]

    try:
        avg = calculate_student_average(student_marks)
        print("Average Marks:", avg)
    except Exception as e:
        print("Error:", e)
```

```
PS C:\Users\Chinnari\Downloads\Devops>  c:; cd 'c:\Users\Chinnari\Downloads\Devops'; & 'C:\Users\Chinnari\AppData\Local\Microsoft\WindowsApps\python3.13.exe' 'c:\Users\Chinnari\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '62145' '--' 'C:\Users\Chinnari\Downloads\new.py'
Average Marks: 86.6

AI Refactoring Explanation:

Readability Improvements:
1. Renamed function to 'calculate_student_average' for clarity.
2. Replaced unclear variable names with descriptive names like 'marks', 'score', and 'total_marks'.
3. Applied proper indentation and spacing following PEP 8 standards.

Maintainability Improvements:
1. Added a clear docstring explaining purpose, arguments, and return value.
2. Added input validation and error handling.
3. Structured the code into a reusable function.
```


File Edit Selection View Go Run Terminal Help
Devops
RUN AND DEBUG
Python ...
VARIABLES
WATCH
CALL STACK
BREAKPOINTS
Raised Exceptions
Uncaught Exceptions
User Uncaught Exceptions
new.py
C: > Users > Chinnari > Downloads > new.py > ...
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
powershell
Python
Python Deb...
Ln 43, Col 1 Spaces: 4 UTF-8 CRLF {} Python

```python

def ai_explanation():
    print("AI Refactoring Explanation:\n")

    print("Readability Improvements:")
    print("1. Renamed function to 'calculate_student_average' for clarity.")
    print("2. Replaced unclear variable names with descriptive names like 'marks', 'score', and 'total_marks'.")
    print("3. Applied proper indentation and spacing following PEP 8 standards.")

    print("\nMaintainability Improvements:")
    print("1. Added a clear docstring explaining purpose, arguments, and return value.")
    print("2. Added input validation and error handling.")
    print("3. Structured the code into a reusable function.")

    print("\nOverall Result:")
    print("The code is now easier to read, understand, modify, and maintain.")


if __name__ == "__main__":
    student_marks = [85, 90, 78, 92, 88]

    try:
        avg = calculate_student_average(student_marks)
        print("Average Marks:", avg)
    except Exception as e:
        print("Error:", e)

    print()
    ai_explanation()

```

```
PS C:\Users\Chinnari\Downloads\Devops>  c:; cd 'c:\Users\Chinnari\Downloads\Devops'; & 'C:\Users\Chinnari\AppData\Local\Microsoft\WindowsApps\python3.13.exe' 'c:\Users\Chinnari\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '62145' '--' 'C:\Users\Chinnari\Downloads\new.py'
2. Replaced unclear variable names with descriptive names like 'marks', 'score', and 'total_marks'.
3. Applied proper indentation and spacing following PEP 8 standards.

Maintainability Improvements:
1. Added a clear docstring explaining purpose, arguments, and return value.
2. Added input validation and error handling.
3. Structured the code into a reusable function.

Overall Result:
The code is now easier to read, understand, modify, and maintain.
PS C:\Users\Chinnari\Downloads\Devops>
```

Task 4: Secure Coding and Reliability Review

Scenario

A backend function retrieves user data from a database but has security vulnerabilities and poor error handling, making it unsafe for production deployment.

Task Description

You are given a Python script that:

- Uses unsafe SQL query construction
- Has no input validation
- Lacks exception handling

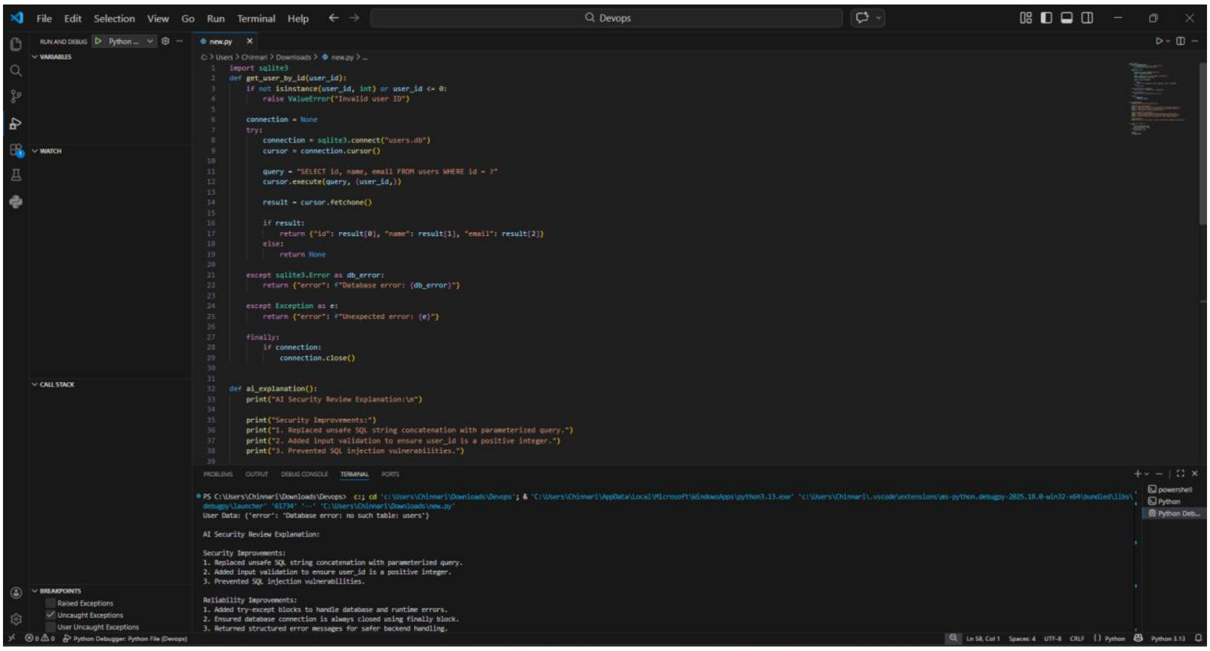
Use AI tools to:

- Identify security vulnerabilities
- Refactor the code using safe coding practices
- Add proper exception handling
- Improve robustness and reliability

Expected Outcome

- Secure SQL queries using parameterized statements
- Input validation logic
- Try-except blocks for runtime safety
- AI-generated explanation of security improvements

- Production-ready code structure give code for this remove comments



```python
import sqlite3
def get_user_by_id(user_id):
    if not isinstance(user_id, int) or user_id <= 0:
        raise ValueError("Invalid user ID")

    connection = None
    try:
        connection = sqlite3.connect("users.db")
        cursor = connection.cursor()

        query = "SELECT id, name, email FROM users WHERE id = ?"
        cursor.execute(query, (user_id,))

        result = cursor.fetchone()

        if result:
            return {"id": result[0], "name": result[1], "email": result[2]}
        else:
            return None

    except sqlite3.Error as db_error:
        return {"error": f"Database error: {db_error}"}

    except Exception as e:
        return {"error": f"Unexpected error: {e}"}

    finally:
        if connection:
            connection.close()


def ai_explanation():
    print("AI Security Review Explanation:\n")

    print("Security Improvements:")
    print("1. Replaced unsafe SQL string concatenation with parameterized query.")
    print("2. Added input validation to ensure user_id is a positive integer.")
    print("3. Prevented SQL injection vulnerabilities.")
```

```
PS C:\Users\Chinnari\Downloads\Devops>  c:; cd 'c:\Users\Chinnari\Downloads\Devops'; & 'C:\Users\Chinnari\AppData\Local\Microsoft\WindowsApps\python3.13.exe' 'c:\Users\Chinnari\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '61734' '--' 'C:\Users\Chinnari\Downloads\new.py'
User Data: {'error': 'Database error: no such table: users'}

AI Security Review Explanation:

Security Improvements:
1. Replaced unsafe SQL string concatenation with parameterized query.
2. Added input validation to ensure user_id is a positive integer.
3. Prevented SQL injection vulnerabilities.

Reliability Improvements:
1. Added try-except blocks to handle database and runtime errors.
2. Ensured database connection is always closed using finally block.
3. Returned structured error messages for safer backend handling.
```

Task 5: AI-Based Automated Code Review Report

Scenario

Your team uses AI tools to perform automated preliminary code reviews

before human review, to improve code quality and consistency across

projects.

Task Description

You are provided with a poorly written Python script.

Using AI-assisted review:

- Generate a structured code review report that evaluates:

o Code readability

o Naming conventions

o Formatting and style consistency

o Error handling

o Documentation quality

o Maintainability

The task is not just to fix the code, but to analyze and report on quality

issues.

Expected Outcome

- AI-generated review report including:

o Identified quality issues

o Risk areas

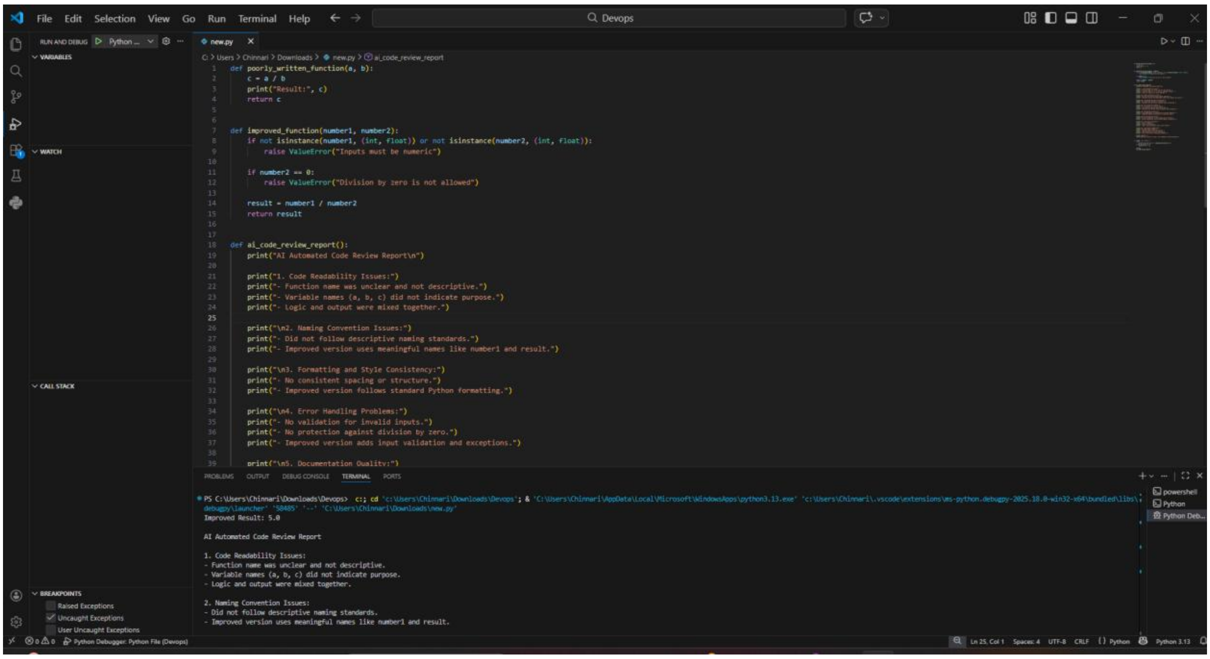
o Code smell detection

o Improvement suggestions

• Optional improved version of the code

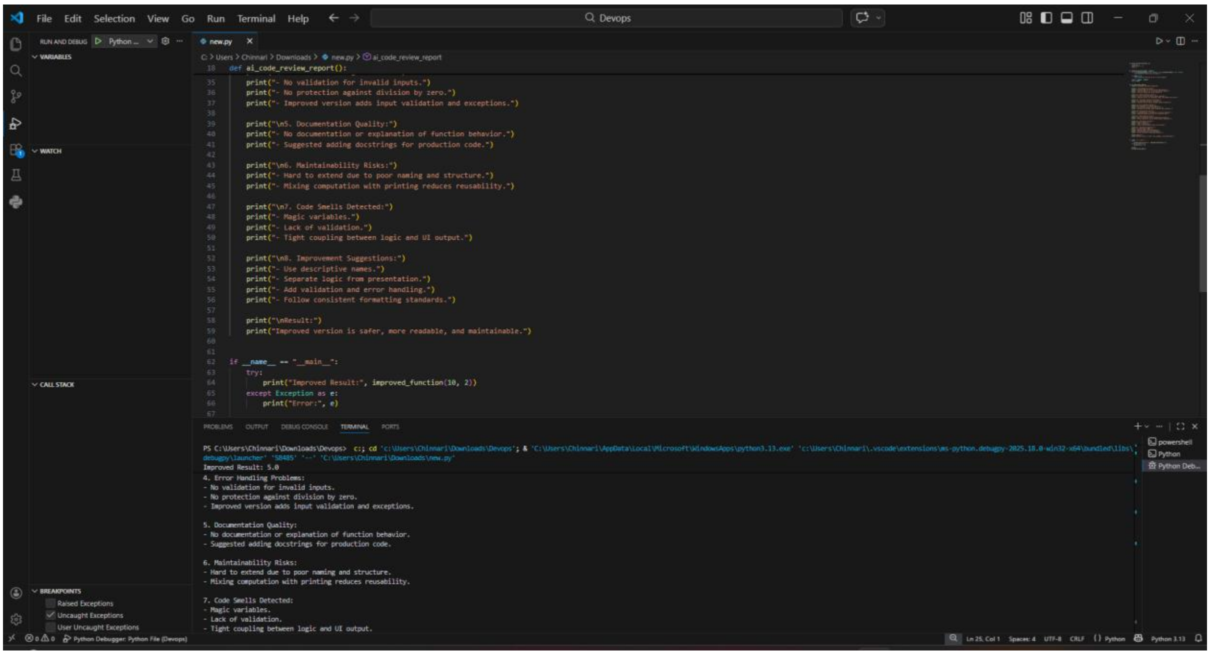
• Demonstration of AI as a code reviewer, not just a code

Generator



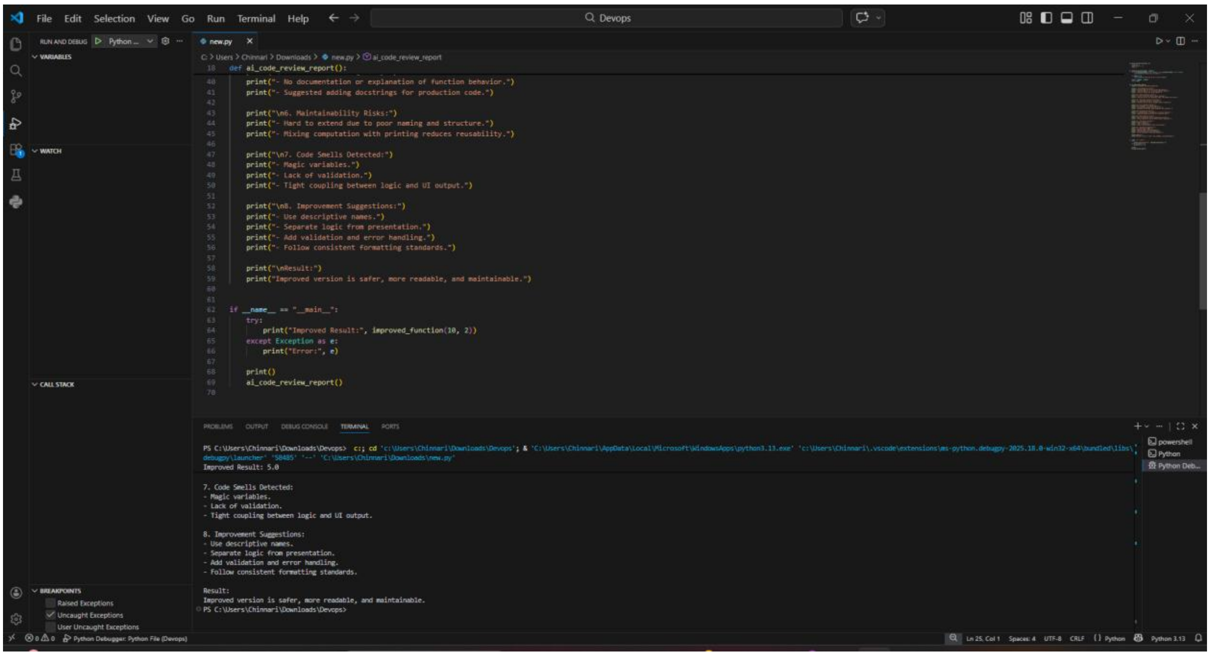
```python
def poorly_written_function(a, b):
    c = a / b
    print("Result:", c)
    return c


def improved_function(number1, number2):
    if not isinstance(number1, (int, float)) or not isinstance(number2, (int, float)):
        raise ValueError("Inputs must be numeric")

    if number2 == 0:
        raise ValueError("Division by zero is not allowed")

    result = number1 / number2
    return result


def ai_code_review_report():
    print("AI Automated Code Review Report\n")

    print("1. Code Readability Issues:")
    print("- Function name was unclear and not descriptive.")
    print("- Variable names (a, b, c) did not indicate purpose.")
    print("- Logic and output were mixed together.")

    print("\n2. Naming Convention Issues:")
    print("- Did not follow descriptive naming standards.")
    print("- Improved version uses meaningful names like number1 and result.")

    print("\n3. Formatting and Style Consistency:")
    print("- No consistent spacing or structure.")
    print("- Improved version follows standard Python formatting.")

    print("\n4. Error Handling Problems:")
    print("- No validation for invalid inputs.")
    print("- No protection against division by zero.")
    print("- Improved version adds input validation and exceptions.")

    print("\n5. Documentation Quality:")
```

```
PS C:\Users\Chinnari\Downloads\Devops>  c:; cd 'c:\Users\Chinnari\Downloads\Devops'; & 'C:\Users\Chinnari\AppData\Local\Microsoft\WindowsApps\python3.13.exe' 'c:\Users\Chinnari\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\
debugpy\launcher' '58485' '--' 'C:\Users\Chinnari\Downloads\new.py'
Improved Result: 5.0

AI Automated Code Review Report

1. Code Readability Issues:
- Function name was unclear and not descriptive.
- Variable names (a, b, c) did not indicate purpose.
- Logic and output were mixed together.

2. Naming Convention Issues:
- Did not follow descriptive naming standards.
- Improved version uses meaningful names like number1 and result.
```



```python
def ai_code_review_report():
    print("- No validation for invalid inputs.")
    print("- No protection against division by zero.")
    print("- Improved version adds input validation and exceptions.")

    print("\n5. Documentation Quality:")
    print("- No documentation or explanation of function behavior.")
    print("- Suggested adding docstrings for production code.")

    print("\n6. Maintainability Risks:")
    print("- Hard to extend due to poor naming and structure.")
    print("- Mixing computation with printing reduces reusability.")

    print("\n7. Code Smells Detected:")
    print("- Magic variables.")
    print("- Lack of validation.")
    print("- Tight coupling between logic and UI output.")

    print("\n8. Improvement Suggestions:")
    print("- Use descriptive names.")
    print("- Separate logic from presentation.")
    print("- Add validation and error handling.")
    print("- Follow consistent formatting standards.")

    print("\nResult:")
    print("Improved version is safer, more readable, and maintainable.")


if __name__ == "__main__":
    try:
        print("Improved Result:", improved_function(10, 2))
    except Exception as e:
        print("Error:", e)
```

```
PS C:\Users\Chinnari\Downloads\Devops>  c:; cd 'c:\Users\Chinnari\Downloads\Devops'; & 'C:\Users\Chinnari\AppData\Local\Microsoft\WindowsApps\python3.13.exe' 'c:\Users\Chinnari\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\
debugpy\launcher' '58485' '--' 'C:\Users\Chinnari\Downloads\new.py'
Improved Result: 5.0
4. Error Handling Problems:
- No validation for invalid inputs.
- No protection against division by zero.
- Improved version adds input validation and exceptions.

5. Documentation Quality:
- No documentation or explanation of function behavior.
- Suggested adding docstrings for production code.

6. Maintainability Risks:
- Hard to extend due to poor naming and structure.
- Mixing computation with printing reduces reusability.

7. Code Smells Detected:
- Magic variables.
- Lack of validation.
- Tight coupling between logic and UI output.
```


File Edit Selection View Go Run Terminal Help
Devops
RUN AND DEBUG
Python ...
VARIABLES
WATCH
CALL STACK
BREAKPOINTS
☐ Raised Exceptions
☑ Uncaught Exceptions
☐ User Uncaught Exceptions
new.py
C: > Users > Chinnari > Downloads > new.py > ai_code_review_report
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
powershell
Python
Python Deb...
Python Debugger: Python File (Devops)
Ln 25, Col 1 Spaces: 4 UTF-8 CRLF {} Python Python 3.13

```python
def ai_code_review_report():
    print("- No documentation or explanation of function behavior.")
    print("- Suggested adding docstrings for production code.")

    print("\n6. Maintainability Risks:")
    print("- Hard to extend due to poor naming and structure.")
    print("- Mixing computation with printing reduces reusability.")

    print("\n7. Code Smells Detected:")
    print("- Magic variables.")
    print("- Lack of validation.")
    print("- Tight coupling between logic and UI output.")

    print("\n8. Improvement Suggestions:")
    print("- Use descriptive names.")
    print("- Separate logic from presentation.")
    print("- Add validation and error handling.")
    print("- Follow consistent formatting standards.")

    print("\nResult:")
    print("Improved version is safer, more readable, and maintainable.")


if __name__ == "__main__":
    try:
        print("Improved Result:", improved_function(10, 2))
    except Exception as e:
        print("Error:", e)

    print()
    ai_code_review_report()
```

```
PS C:\Users\Chinnari\Downloads\Devops>  c:; cd 'c:\Users\Chinnari\Downloads\Devops'; & 'C:\Users\Chinnari\AppData\Local\Microsoft\WindowsApps\python3.13.exe' 'c:\Users\Chinnari\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '58485' '--' 'C:\Users\Chinnari\Downloads\new.py'
Improved Result: 5.0

7. Code Smells Detected:
- Magic variables.
- Lack of validation.
- Tight coupling between logic and UI output.

8. Improvement Suggestions:
- Use descriptive names.
- Separate logic from presentation.
- Add validation and error handling.
- Follow consistent formatting standards.

Result:
Improved version is safer, more readable, and maintainable.
PS C:\Users\Chinnari\Downloads\Devops>
```