AI Assisted Coding Assignment-13.1

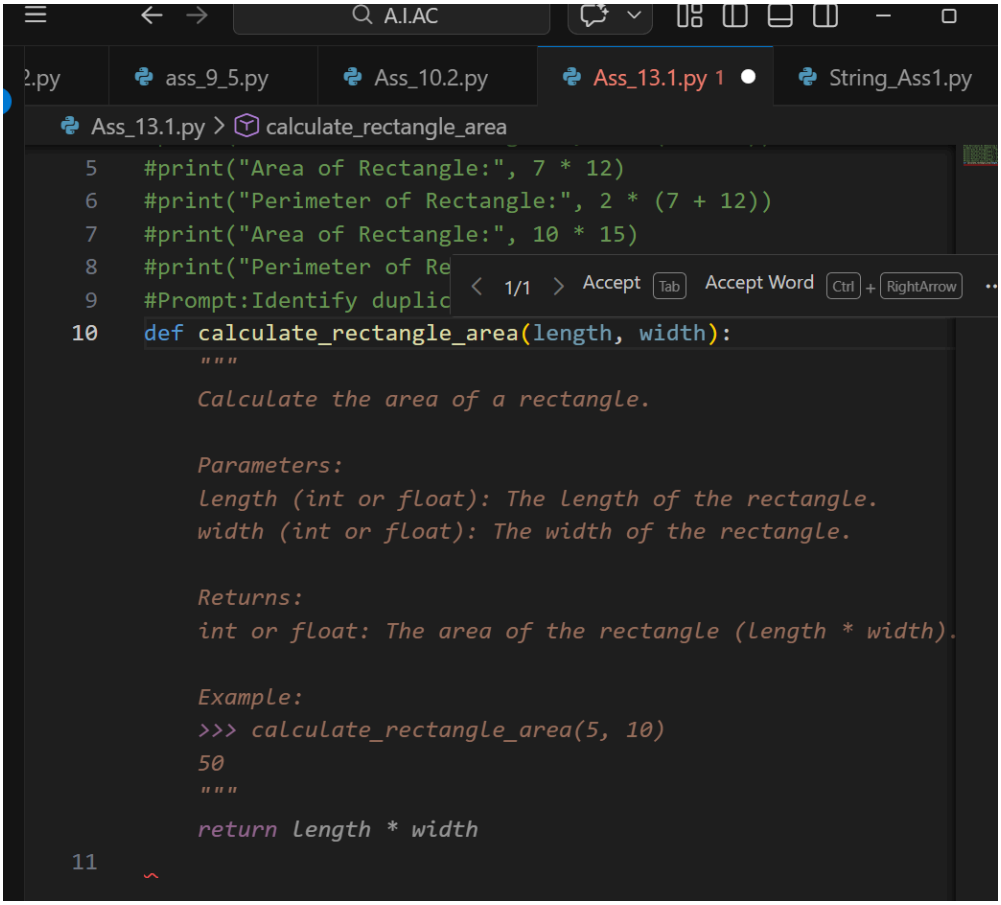
💡 **Task Description #1 (Refactoring – Removing Code Duplication)**

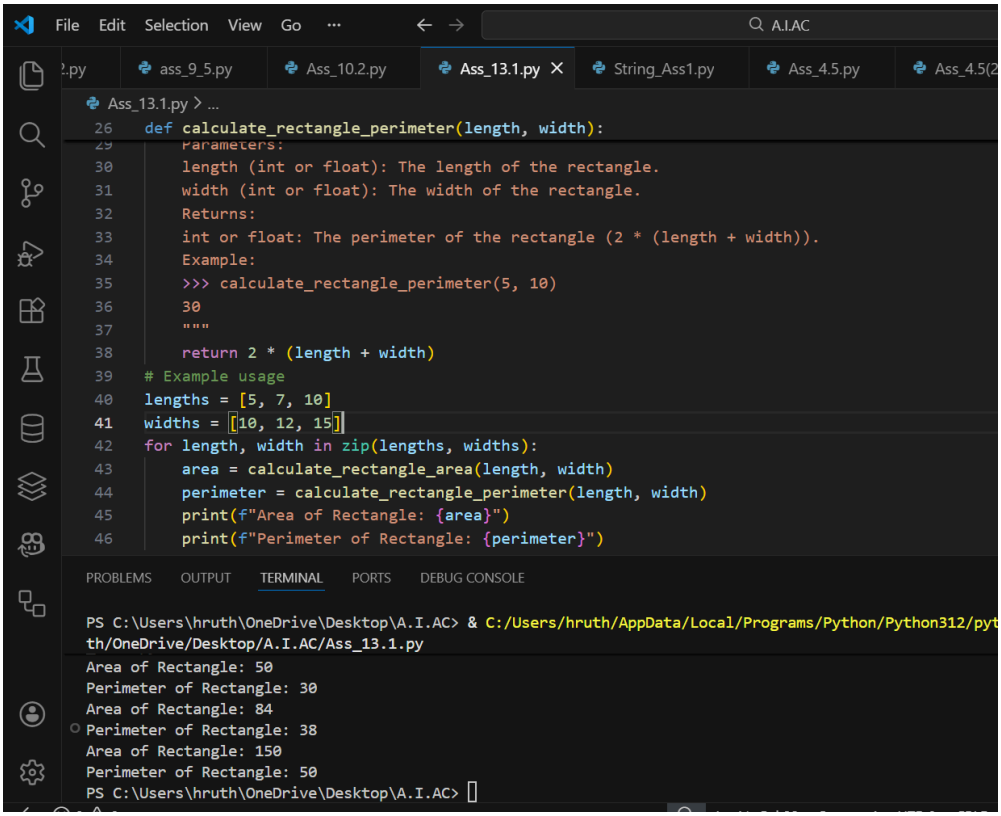
- Task: Use AI to refactor a given Python script that contains multiple repeated code blocks.
- Instructions:
  - Prompt AI to identify duplicate logic and replace it with functions or classes.
  - Ensure the refactored code maintains the same output.
  - Add docstrings to all functions.
- Sample Legacy Code:

```
# Legacy script with repeated logic
print("Area of Rectangle:", 5 * 10)
print("Perimeter of Rectangle:", 2 * (5 + 10))
print("Area of Rectangle:", 7 * 12)
print("Perimeter of Rectangle:", 2 * (7 + 12))
print("Area of Rectangle:", 10 * 15)
print("Perimeter of Rectangle:", 2 * (10 + 15))
```

- Expected Output:
  - Refactored code with a reusable function and no duplication.

Well documented code


A.I.AC
ass_9_5.py
Ass_10.2.py
Ass_13.1.py 1
String_Ass1.py
Ass_13.1.py > calculate_rectangle_area
#print("Area of Rectangle:", 7 * 12)
#print("Perimeter of Rectangle:", 2 * (7 + 12))
#print("Area of Rectangle:", 10 * 15)
#print("Perimeter of Re
#Prompt:Identify duplic
1/1
Accept
Tab
Accept Word
Ctrl + RightArrow
def calculate_rectangle_area(length, width):
"""
Calculate the area of a rectangle.
Parameters:
length (int or float): The length of the rectangle.
width (int or float): The width of the rectangle.
Returns:
int or float: The area of the rectangle (length * width).
Example:
>>> calculate_rectangle_area(5, 10)
50
"""
return length * width

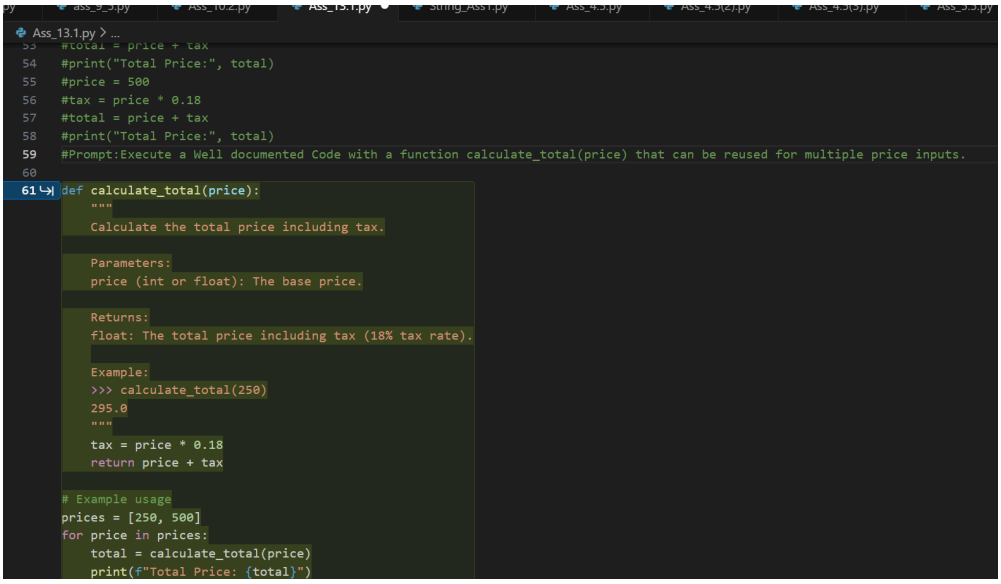


Task Description #2 (Refactoring – Extracting Reusable Functions)

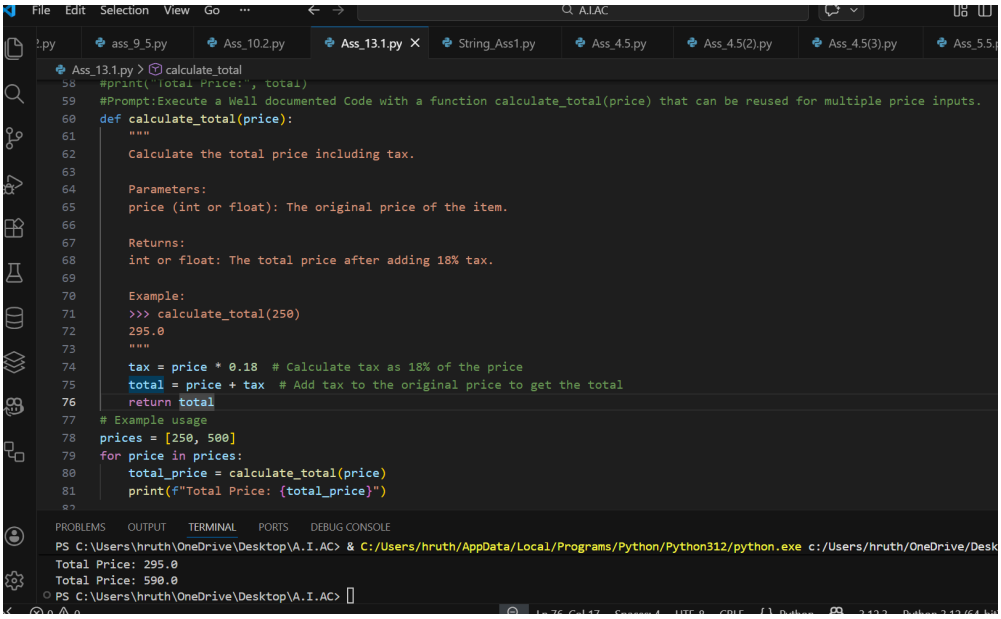
- Task: Use AI to refactor a legacy script where multiple calculations are embedded directly inside the main code block.
- Instructions:
  - Identify repeated or related logic and extract it into reusable functions.
  - Ensure the refactored code is modular, easy to read, and documented with docstrings.
- Sample Legacy Code:

```
# Legacy script with inline repeated logic
price = 250
tax = price * 0.18
total = price + tax
print("Total Price:", total)
price = 500
tax = price * 0.18
total = price + tax
print("Total Price:", total)
```

- Expected Output:
  - Code with a function calculate_total(price) that can be reused for multiple price inputs.
  - Well documented code



```python
#total = price + tax
#print("Total Price:", total)
#price = 500
#tax = price * 0.18
#total = price + tax
#print("Total Price:", total)
#Prompt:Execute a Well documented Code with a function calculate_total(price) that can be reused for multiple price inputs.

def calculate_total(price):
    """
    Calculate the total price including tax.

    Parameters:
    price (int or float): The base price.

    Returns:
    float: The total price including tax (18% tax rate).

    Example:
    >>> calculate_total(250)
    295.0
    """
    tax = price * 0.18
    return price + tax

# Example usage
prices = [250, 500]
for price in prices:
    total = calculate_total(price)
    print(f"Total Price: {total}")
```



```python
#print("Total Price:", total)
#Prompt:Execute a Well documented Code with a function calculate_total(price) that can be reused for multiple price inputs.
def calculate_total(price):
    """
    Calculate the total price including tax.

    Parameters:
    price (int or float): The original price of the item.

    Returns:
    int or float: The total price after adding 18% tax.

    Example:
    >>> calculate_total(250)
    295.0
    """
    tax = price * 0.18  # Calculate tax as 18% of the price
    total = price + tax  # Add tax to the original price to get the total
    return total
# Example usage
prices = [250, 500]
for price in prices:
    total_price = calculate_total(price)
    print(f"Total Price: {total_price}")
```

```
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC> & C:/Users/hruth/AppData/Local/Programs/Python/Python312/python.exe c:/Users/hruth/OneDrive/Desk
Total Price: 295.0
Total Price: 590.0
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC>
```

Task Description #3: Refactoring Using Classes and Methods (Eliminating Redundant Conditional Logic)
Refactor a Python script that contains repeated if–elif–else grading logic by implementing a structured, object-oriented solution using a class and a method.
Problem Statement
The given script contains duplicated conditional statements used to assign grades based on student marks. This redundancy violates clean code principles and reduces maintainability.
You are required to refactor the script using a class-based design to improve modularity, reusability, and readability while preserving the original grading logic.
Mandatory Implementation Requirements

1. Class Name: GradeCalculator
2. Method Name: calculate_grade(self, marks)
3. The method must:
    - Accept marks as a parameter.
    - Return the corresponding grade as a string.
    - The grading logic must strictly follow the conditions below:

- Marks ≥ 90 and ≤ 100 → "Grade A"
- Marks ≥ 80 → "Grade B"
- Marks ≥ 70 → "Grade C"
- Marks ≥ 40 → "Grade D"
- Marks ≥ 0 → "Fail"

Note: Assume marks are within the valid range of 0 to 100.

1. Include proper docstrings for:
    - The class
    - The method (with parameter and return descriptions)
2. The method must be reusable and called multiple times without rewriting conditional logic.

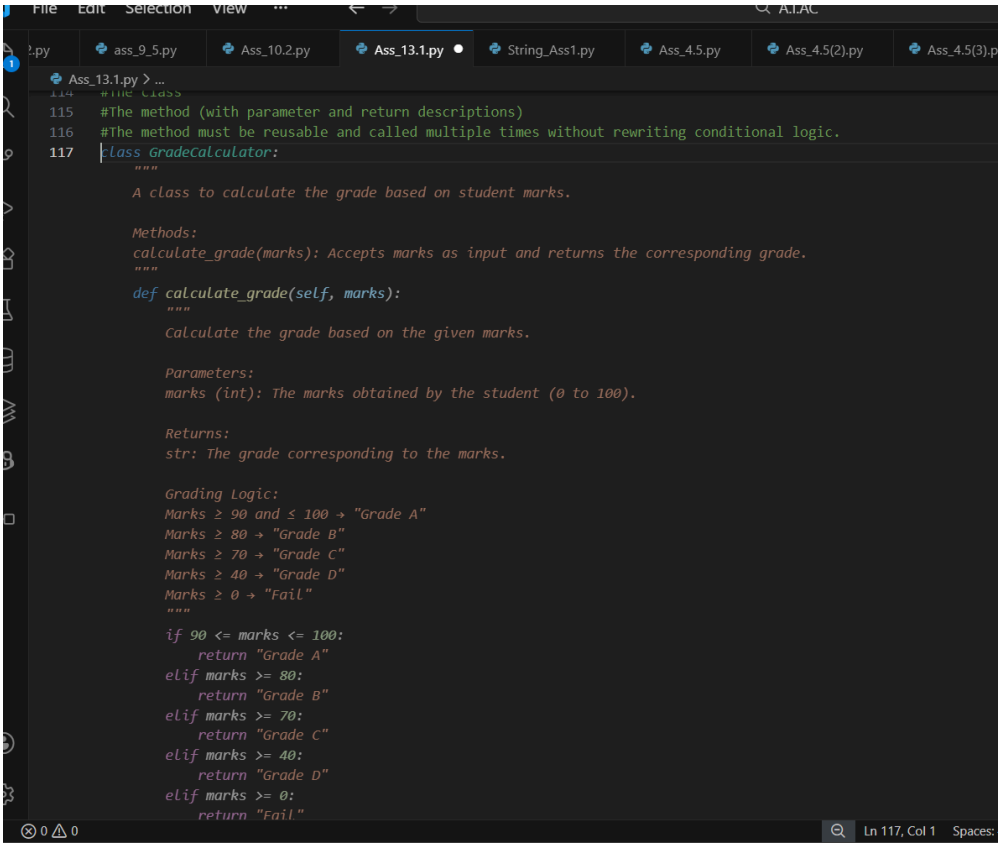
- Given code:

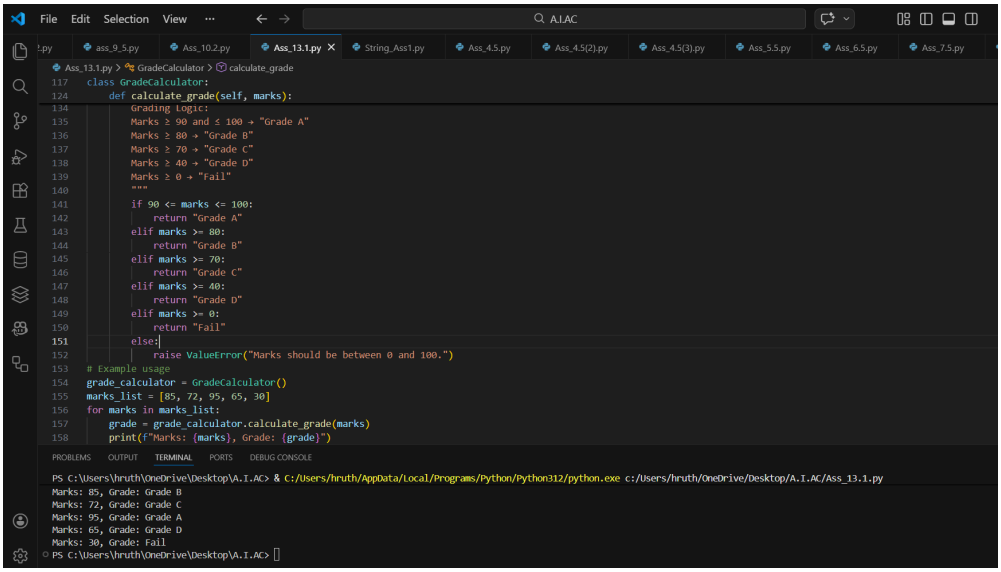
```
marks = 85
if marks >= 90:
print("Grade A")
elif marks >= 75:
print("Grade B")
else:
print("Grade C")
marks = 72
if marks >= 90:
print("Grade A")
elif marks >= 75:
print("Grade B")
else:
print("Grade C")
```

Expected Output:

- Define a class named GradeCalculator.

- Implement a method calculate_grade(self, marks) inside the class.
- Create an object of the class.
- Call the method for different student marks.
- Print the returned grade values.





Task Description #4 (Refactoring – Converting Procedural Code to Functions)

- **Task: Use AI to refactor procedural input–processing logic into functions.**

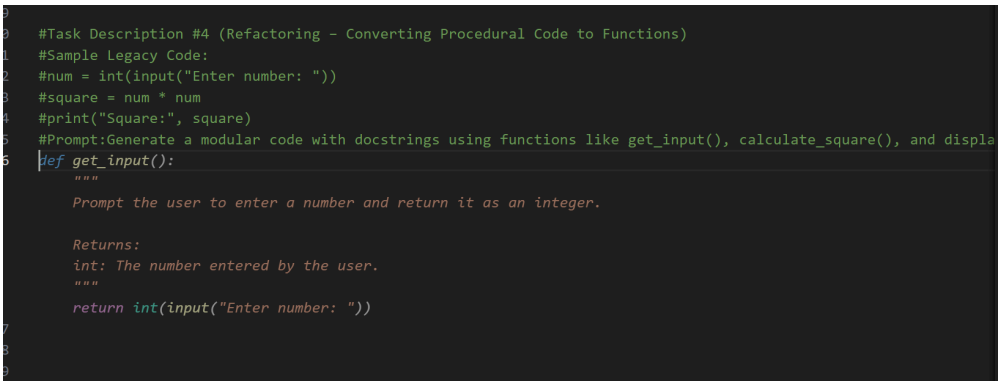
Instructions:
o Identify input, processing, and output sections.
o Convert each into a separate function.
o Improve code readability without changing behavior.

- Sample Legacy Code:

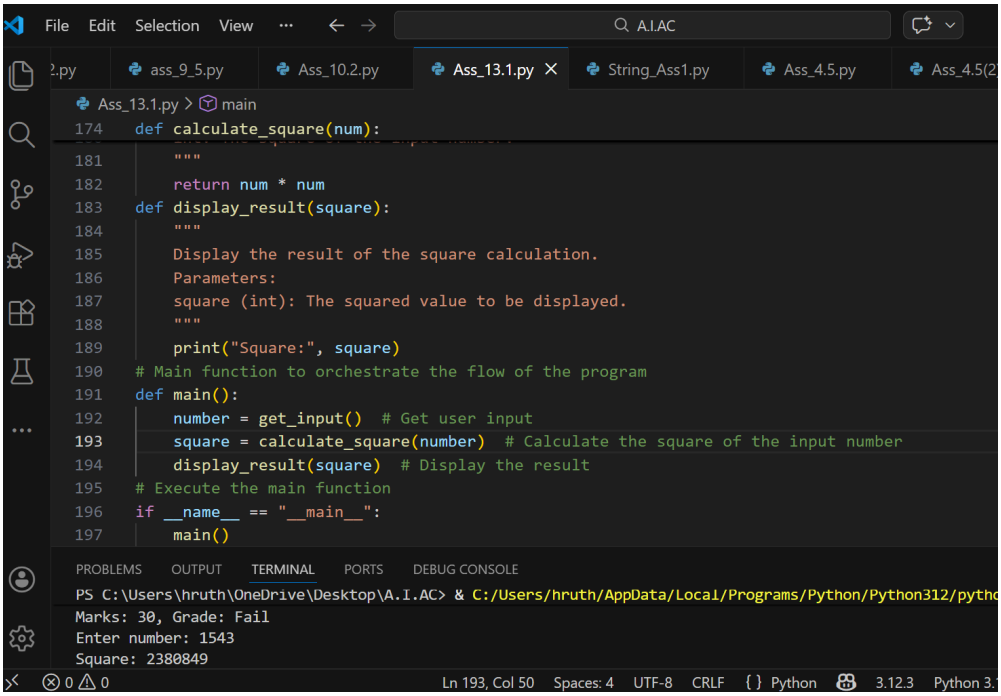
```
num = int(input("Enter number: "))
square = num * num
print("Square:", square)
```

- Expected Output:

o Modular code using functions like get_input(), calculate_square(), and display_result().



```
#Task Description #4 (Refactoring – Converting Procedural Code to Functions)
#Sample Legacy Code:
#num = int(input("Enter number: "))
#square = num * num
#print("Square:", square)
#Prompt:Generate a modular code with docstrings using functions like get_input(), calculate_square(), and displa
def get_input():
    """
    Prompt the user to enter a number and return it as an integer.

    Returns:
    int: The number entered by the user.
    """
    return int(input("Enter number: "))
```



```
File  Edit  Selection  View  ···   A.I.AC
ass_9_5.py  Ass_10.2.py  Ass_13.1.py  String_Ass1.py  Ass_4.5.py
Ass_13.1.py > main
174  def calculate_square(num):
181      """
182      return num * num
183  def display_result(square):
184      """
185      Display the result of the square calculation.
186      Parameters:
187      square (int): The squared value to be displayed.
188      """
189      print("Square:", square)
190  # Main function to orchestrate the flow of the program
191  def main():
192      number = get_input()  # Get user input
193      square = calculate_square(number)  # Calculate the square of the input number
194      display_result(square)  # Display the result
195  # Execute the main function
196  if __name__ == "__main__":
197      main()
PROBLEMS  OUTPUT  TERMINAL  PORTS  DEBUG CONSOLE
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC> & C:/Users/hruth/AppData/Local/Programs/Python/Python312/pytho
Marks: 30, Grade: Fail
Enter number: 1543
Square: 2380849
Ln 193, Col 50  Spaces: 4  UTF-8  CRLF  { } Python  3.12.3  Python 3.
```

Task Description #4 (Refactoring – Converting Procedural Code to Functions)

- **Task: Use AI to refactor procedural input–processing logic into functions.**

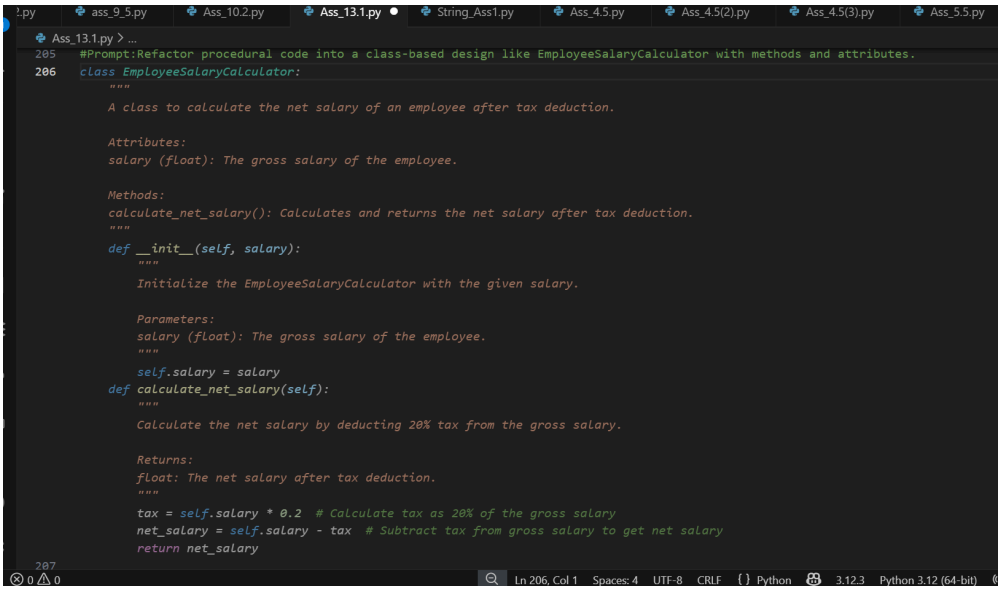
Instructions:
o Identify input, processing, and output sections.
o Convert each into a separate function.
o Improve code readability without changing behavior.

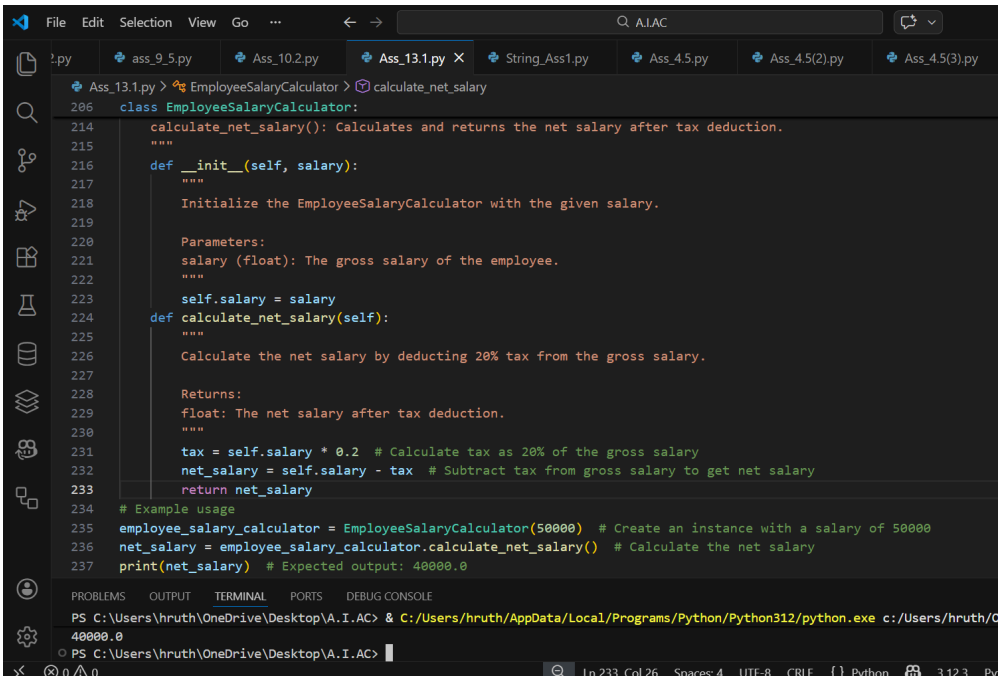
- Sample Legacy Code:

```
num = int(input("Enter number: "))
square = num * num
print("Square:", square)
```

- Expected Output:

o Modular code using functions like get_input(), calculate_square(), and display_result().

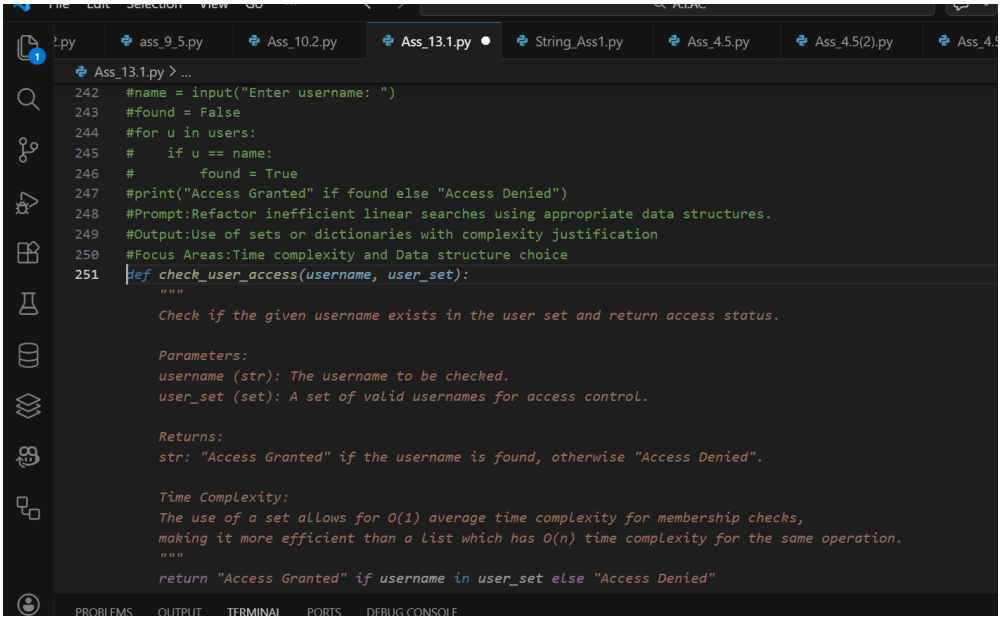


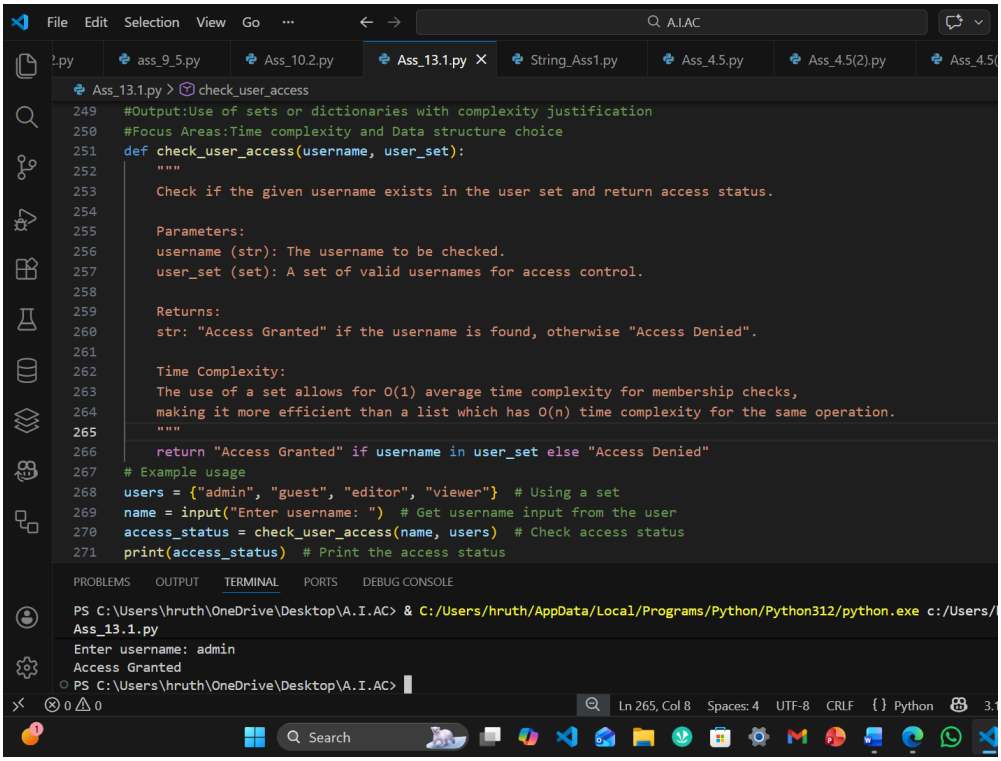


💡 **Task 6 (Optimizing Search Logic)**

- **Task: Refactor inefficient linear searches using appropriate data structures.**Focus Areas:o Time complexityo Data structure choice

Legacy Code:
users = ["admin", "guest", "editor", "viewer"]
name = input("Enter username: ")
found = False
for u in users:
if u == name:
found = True
print("Access Granted" if found else "Access Denied")
Expected Outcome:
o Use of sets or dictionaries with complexity justification


ass_9_5.py
Ass_10.2.py
Ass_13.1.py
String_Ass1.py
Ass_4.5.py
Ass_4.5(2).py
Ass_13.1.py > ...
#name = input("Enter username: ")
#found = False
#for u in users:
if u == name:
found = True
#print("Access Granted" if found else "Access Denied")
#Prompt:Refactor inefficient linear searches using appropriate data structures.
#Output:Use of sets or dictionaries with complexity justification
#Focus Areas:Time complexity and Data structure choice
def check_user_access(username, user_set):
"""
Check if the given username exists in the user set and return access status.
Parameters:
username (str): The username to be checked.
user_set (set): A set of valid usernames for access control.
Returns:
str: "Access Granted" if the username is found, otherwise "Access Denied".
Time Complexity:
The use of a set allows for O(1) average time complexity for membership checks,
making it more efficient than a list which has O(n) time complexity for the same operation.
"""
return "Access Granted" if username in user_set else "Access Denied"
PROBLEMS
OUTPUT
TERMINAL
PORTS
DEBUG CONSOLE


File
Edit
Selection
View
Go
A.I.AC
ass_9_5.py
Ass_10.2.py
Ass_13.1.py
String_Ass1.py
Ass_4.5.py
Ass_4.5(2).py
Ass_13.1.py > check_user_access
#Output:Use of sets or dictionaries with complexity justification
#Focus Areas:Time complexity and Data structure choice
def check_user_access(username, user_set):
"""
Check if the given username exists in the user set and return access status.
Parameters:
username (str): The username to be checked.
user_set (set): A set of valid usernames for access control.
Returns:
str: "Access Granted" if the username is found, otherwise "Access Denied".
Time Complexity:
The use of a set allows for O(1) average time complexity for membership checks,
making it more efficient than a list which has O(n) time complexity for the same operation.
"""
return "Access Granted" if username in user_set else "Access Denied"
# Example usage
users = {"admin", "guest", "editor", "viewer"} # Using a set
name = input("Enter username: ") # Get username input from the user
access_status = check_user_access(name, users) # Check access status
print(access_status) # Print the access status
PROBLEMS
OUTPUT
TERMINAL
PORTS
DEBUG CONSOLE
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC> & C:/Users/hruth/AppData/Local/Programs/Python/Python312/python.exe c:/Users/
Ass_13.1.py
Enter username: admin
Access Granted
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC>
Ln 265, Col 8
Spaces: 4
UTF-8
CRLF
Python
Search

Task 7 – Refactoring the Library Management System

Problem Statement

You are provided with a poorly structured Library Management script that:

- Contains repeated conditional logic
- Does not use reusable functions
- Lacks documentation
- Uses print-based procedural execution
- Does not follow modular programming principles

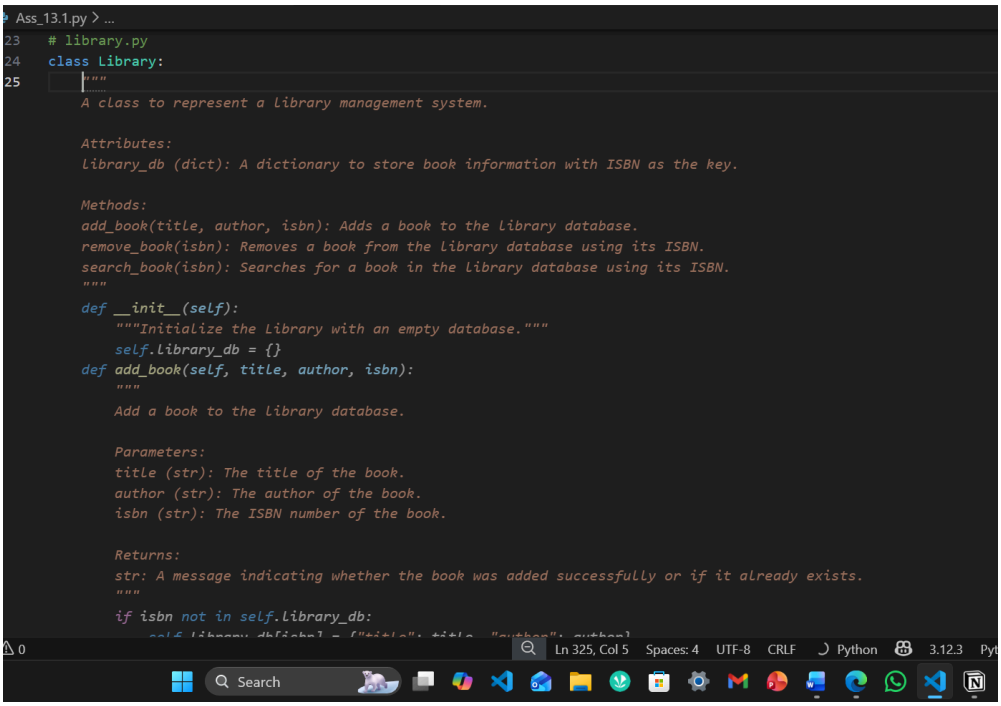
Your task is to refactor the code into a proper format

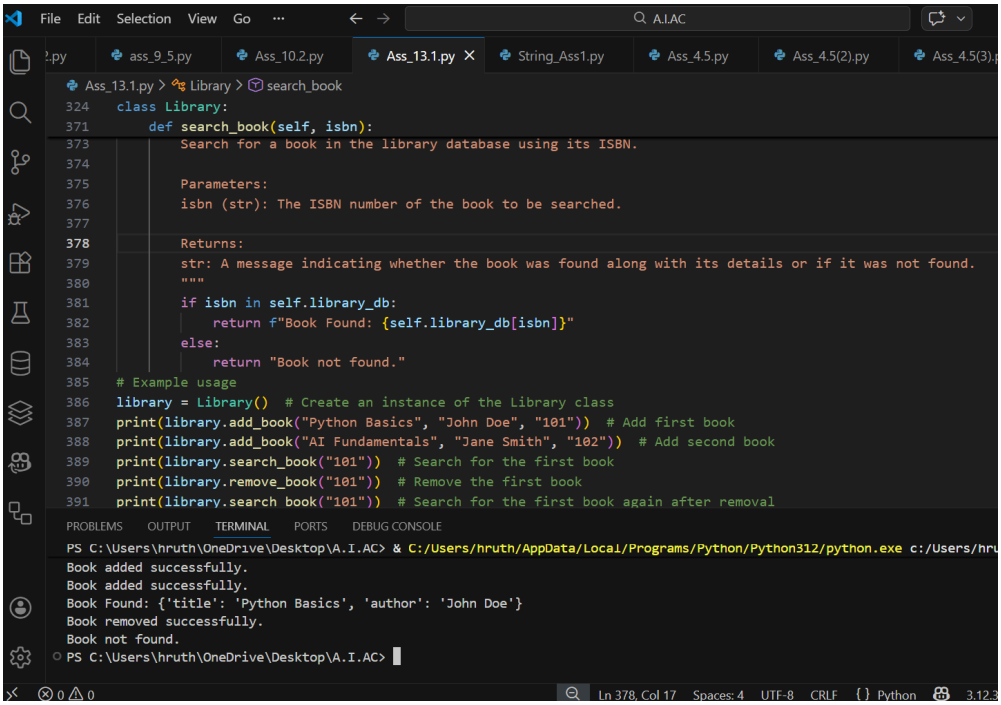
1. Create a module library.py with functions:
   - add_book(title, author, isbn)
   - remove_book(isbn)
   - search_book(isbn)
2. Insert triple quotes under each function and let Copilot complete the docstrings.
3. Generate documentation in the terminal.
4. Export the documentation in HTML format.
5. Open the file in a browser.

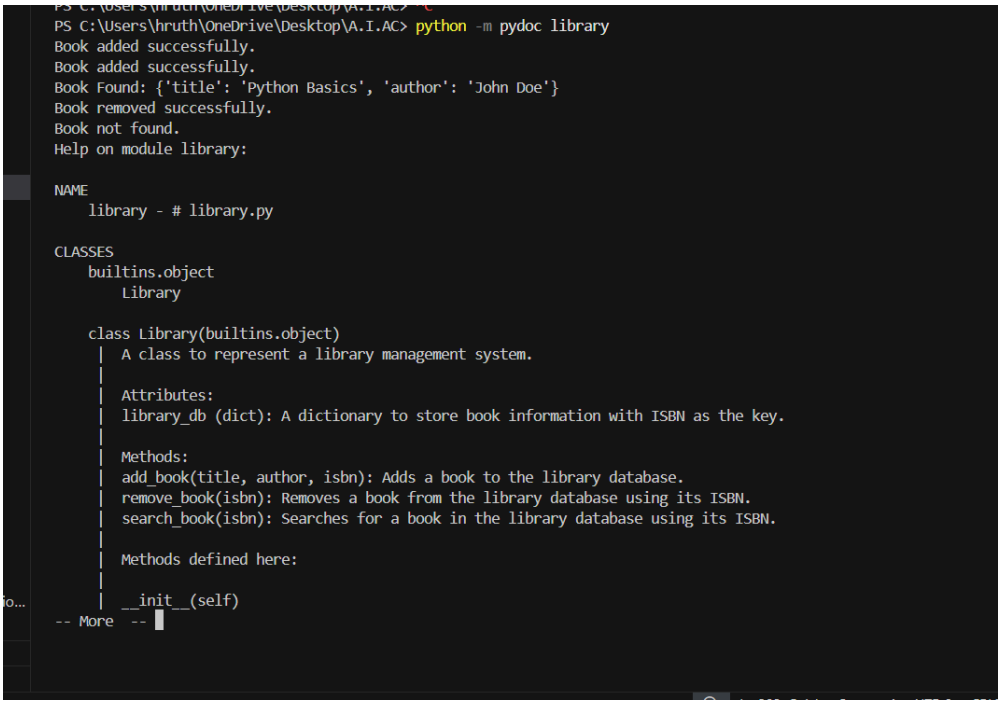
Given Code

```
# Library Management System (Unstructured Version)
# This code needs refactoring into a proper module with documentation.
library_db = {}
# Adding first book
title = "Python Basics"
author = "John Doe"
isbn = "101"
if isbn not in library_db:
library_db[isbn] = {"title": title, "author": author}
print("Book added successfully.")
else:
print("Book already exists.")
# Adding second book (duplicate logic)
title = "AI Fundamentals"
author = "Jane Smith"
isbn = "102"
if isbn not in library_db:
library_db[isbn] = {"title": title, "author": author}
print("Book added successfully.")
else:
print("Book already exists.")
# Searching book (repeated logic structure)
isbn = "101"
if isbn in library_db:
print("Book Found:", library_db[isbn])
else:
```

```
print("Book not found.")
# Removing book (again repeated pattern)
isbn = "101"
if isbn in library_db:
del library_db[isbn]
print("Book removed successfully.")
else:
print("Book not found.")
#Searching again
isbn = "101"
if isbn in library_db:
print("Book Found:", library_db[isbn])
else:
print("Book not found.")
```

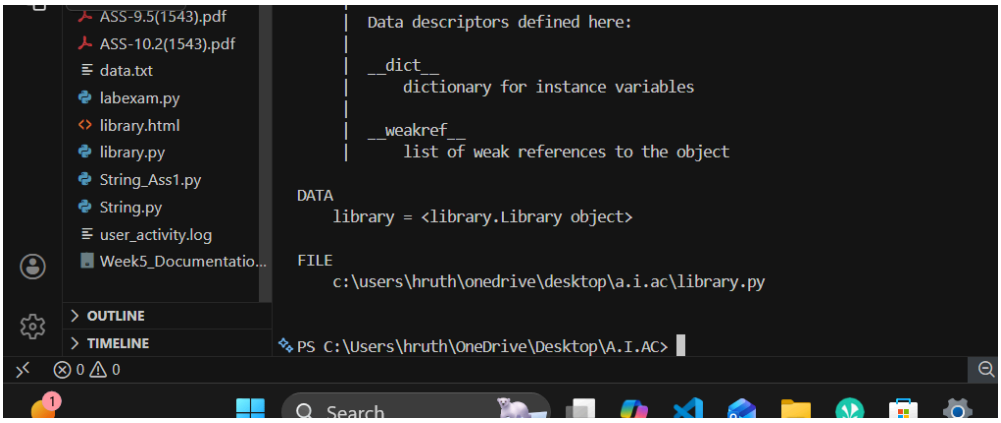


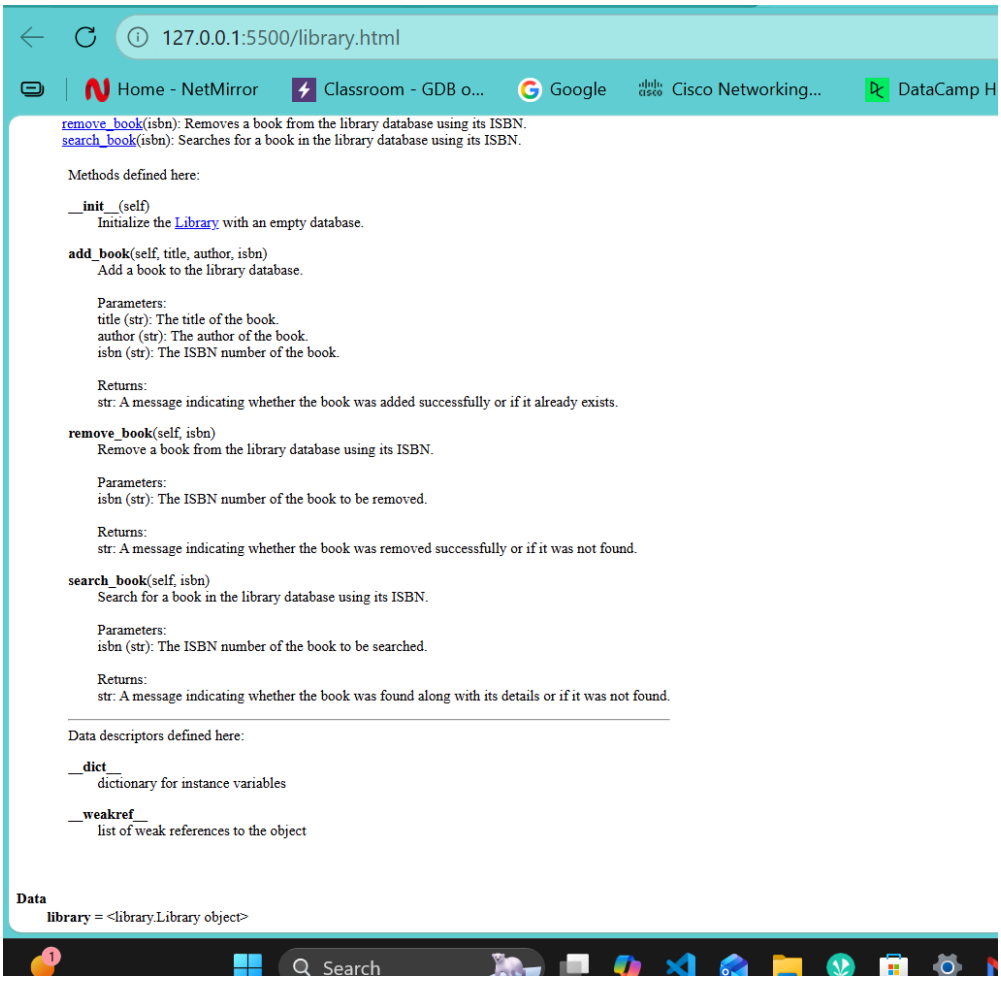

File Edit Selection View Go ...
A.I.AC
ass_9_5.py
Ass_10.2.py
Ass_13.1.py
String_Ass1.py
Ass_4.5.py
Ass_4.5(2).py
Ass_13.1.py > Library > search_book
class Library:
def search_book(self, isbn):
Search for a book in the library database using its ISBN.
Parameters:
isbn (str): The ISBN number of the book to be searched.
Returns:
str: A message indicating whether the book was found along with its details or if it was not found.
"""
if isbn in self.library_db:
return f"Book Found: {self.library_db[isbn]}"
else:
return "Book not found."
# Example usage
library = Library() # Create an instance of the Library class
print(library.add_book("Python Basics", "John Doe", "101")) # Add first book
print(library.add_book("AI Fundamentals", "Jane Smith", "102")) # Add second book
print(library.search_book("101")) # Search for the first book
print(library.remove_book("101")) # Remove the first book
print(library.search_book("101")) # Search for the first book again after removal
PROBLEMS OUTPUT TERMINAL PORTS DEBUG CONSOLE
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC> & C:/Users/hruth/AppData/Local/Programs/Python/Python312/python.exe c:/Users/hru
Book added successfully.
Book added successfully.
Book Found: {'title': 'Python Basics', 'author': 'John Doe'}
Book removed successfully.
Book not found.
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC>
Ln 378, Col 17 Spaces: 4 UTF-8 CRLF { } Python


PS C:\Users\hruth\OneDrive\Desktop\A.I.AC> python -m pydoc library
Book added successfully.
Book added successfully.
Book Found: {'title': 'Python Basics', 'author': 'John Doe'}
Book removed successfully.
Book not found.
Help on module library:
NAME
library - # library.py
CLASSES
builtins.object
Library
class Library(builtins.object)
| A class to represent a library management system.
|
| Attributes:
| library_db (dict): A dictionary to store book information with ISBN as the key.
|
| Methods:
| add_book(title, author, isbn): Adds a book to the library database.
| remove_book(isbn): Removes a book from the library database using its ISBN.
| search_book(isbn): Searches for a book in the library database using its ISBN.
|
| Methods defined here:
|
| __init__(self)
-- More --

```
    |     Initialize the Library with an empty database.
    |
    | add_book(self, title, author, isbn)
    |     Add a book to the library database.
    |
    |     Parameters:
    |     title (str): The title of the book.
    |     author (str): The author of the book.
    |     isbn (str): The ISBN number of the book.
    |
    |     Returns:
    |     str: A message indicating whether the book was added successfully or if it already exists.
    |
    | remove_book(self, isbn)
    |     Remove a book from the library database using its ISBN.
    |
    |     Parameters:
    |     isbn (str): The ISBN number of the book to be removed.
    |
    |     Returns:
    |     str: A message indicating whether the book was removed successfully or if it was not found.
    |
    | search_book(self, isbn)
    |     Search for a book in the library database using its ISBN.
    |
    |     Parameters:
    |     isbn (str): The ISBN number of the book to be searched.
    |
    |     Returns:
    |     str: A message indicating whether the book was found along with its details or if it was not found.
    |
    | ----------------------------------------------------------------------
    | Data descriptors defined here:
    |
    | __dict__
```

Ln 393, Col 1 Spaces: 4 UTF-8 CRLF { } Python 3.12.3




127.0.0.1:5500/library.html
Home - NetMirror
Classroom - GDB o...
Google
Cisco Networking...
DataCamp H
remove_book(isbn): Removes a book from the library database using its ISBN.
search_book(isbn): Searches for a book in the library database using its ISBN.
Methods defined here:
__init__(self)
Initialize the Library with an empty database.
add_book(self, title, author, isbn)
Add a book to the library database.
Parameters:
title (str): The title of the book.
author (str): The author of the book.
isbn (str): The ISBN number of the book.
Returns:
str: A message indicating whether the book was added successfully or if it already exists.
remove_book(self, isbn)
Remove a book from the library database using its ISBN.
Parameters:
isbn (str): The ISBN number of the book to be removed.
Returns:
str: A message indicating whether the book was removed successfully or if it was not found.
search_book(self, isbn)
Search for a book in the library database using its ISBN.
Parameters:
isbn (str): The ISBN number of the book to be searched.
Returns:
str: A message indicating whether the book was found along with its details or if it was not found.
Data descriptors defined here:
__dict__
dictionary for instance variables
__weakref__
list of weak references to the object
Data
library = <library.Library object>
Search

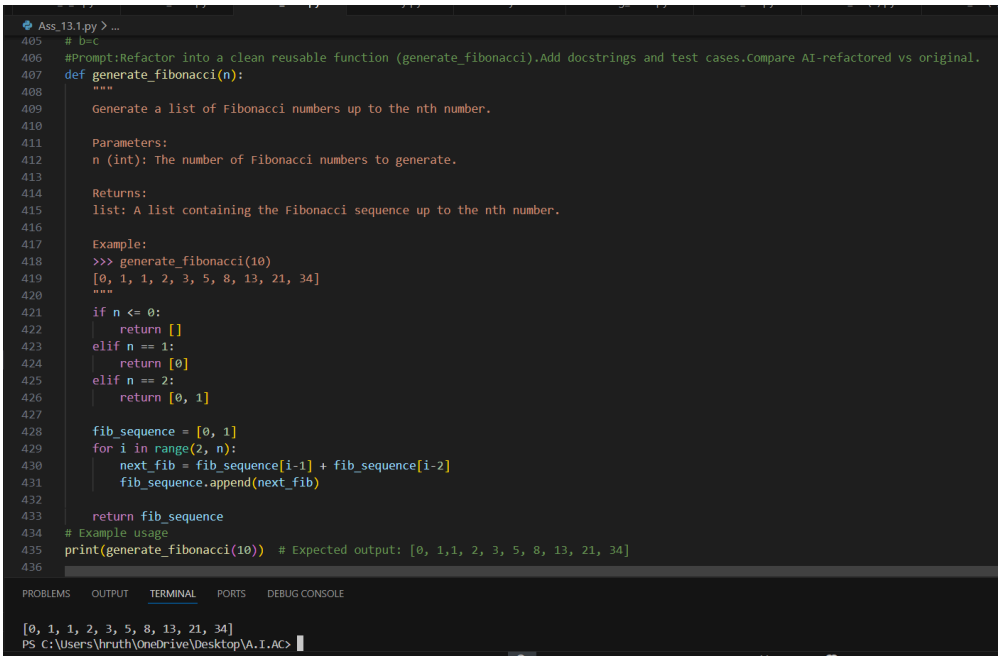
Task 8– Fibonacci Generator.
Write a program to generate Fibonacci series up to n.
The initial code has:

- Global variables.
- Inefficient loop.
- No functions or modularity.

Task for Students:

- Refactor into a clean reusable function (generate_fibonacci).
- Add docstrings and test cases.
- Compare AI-refactored vs original.

Bad Code Version:
# fibonacci bad version
n=int(input("Enter limit: "))
a=0
b=1
print(a)
print(b)
for i in range(2,n):
c=a+b
print(c)
a=b
b=c



Task 9 – Twin Primes Checker
Twin primes are pairs of primes that differ by 2 (e.g., 11 and 13, 17 and 19).
The initial code has:

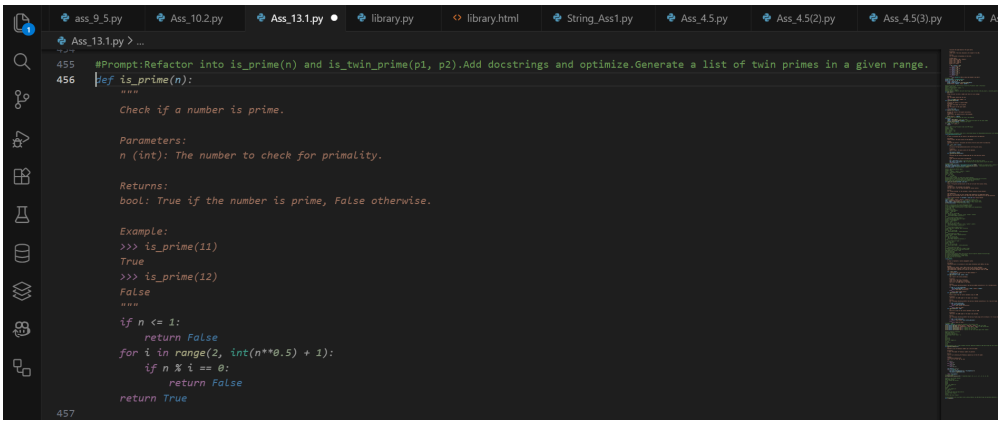
- Inefficient prime checking.
- No functions.
- Hardcoded inputs.

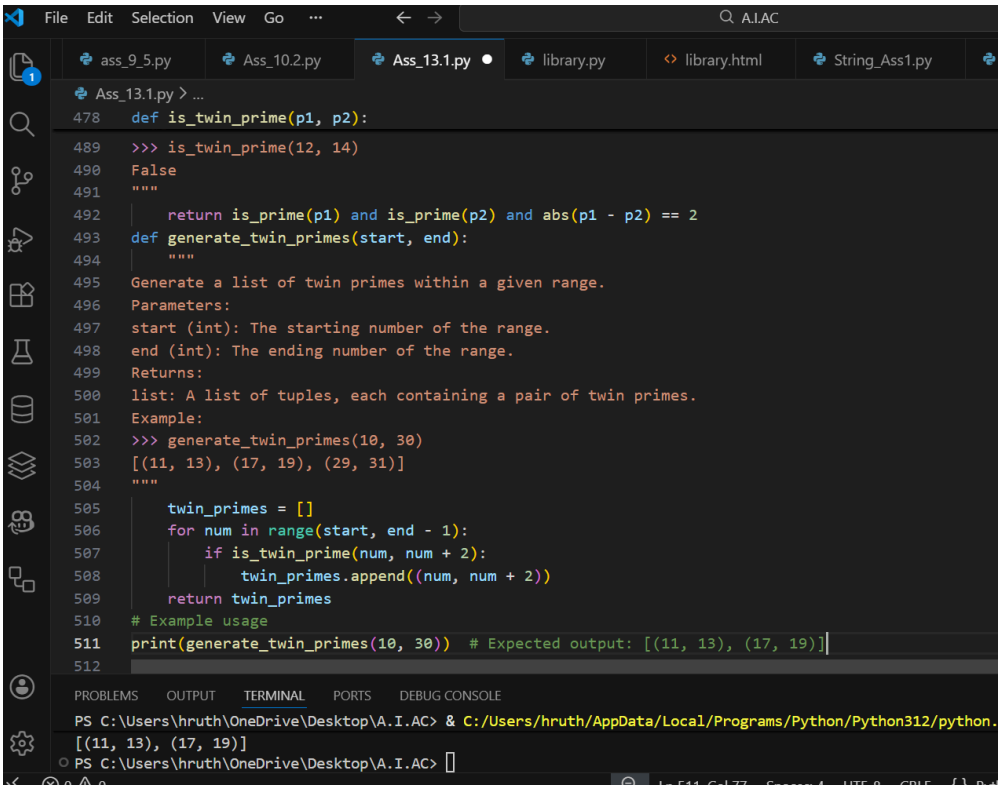
Task for Students:

- Refactor into is_prime(n) and is_twin_prime(p1, p2).
- Add docstrings and optimize.
- Generate a list of twin primes in a given range using AI.

Bad Code Version:

```
# twin primes bad version
a=11
b=13
fa=0
for i in range(2,a):
if a%i==0:
fa=1
fb=0
for i in range(2,b):
if b%i==0:
fb=1
if fa==0 and fb==0 and abs(a-b)==2:
print("Twin Primes")
else:
print("Not Twin Primes")
```


ass_9_5.py
Ass_10.2.py
Ass_13.1.py
library.py
library.html
String_Ass1.py
Ass_4.5.py
Ass_4.5(2).py
Ass_4.5(3).py
Ass_13.1.py > ...
455 #Prompt:Refactor into is_prime(n) and is_twin_prime(p1, p2).Add docstrings and optimize.Generate a list of twin primes in a given range.
456 def is_prime(n):
"""
Check if a number is prime.
Parameters:
n (int): The number to check for primality.
Returns:
bool: True if the number is prime, False otherwise.
Example:
>>> is_prime(11)
True
>>> is_prime(12)
False
"""
if n <= 1:
return False
for i in range(2, int(n**0.5) + 1):
if n % i == 0:
return False
return True
457


File Edit Selection View Go ···
A.I.AC
ass_9_5.py
Ass_10.2.py
Ass_13.1.py
library.py
library.html
String_Ass1.py
Ass_13.1.py > ...
478 def is_twin_prime(p1, p2):
489 >>> is_twin_prime(12, 14)
490 False
491 """
492 return is_prime(p1) and is_prime(p2) and abs(p1 - p2) == 2
493 def generate_twin_primes(start, end):
494 """
495 Generate a list of twin primes within a given range.
496 Parameters:
497 start (int): The starting number of the range.
498 end (int): The ending number of the range.
499 Returns:
500 list: A list of tuples, each containing a pair of twin primes.
501 Example:
502 >>> generate_twin_primes(10, 30)
503 [(11, 13), (17, 19), (29, 31)]
504 """
505 twin_primes = []
506 for num in range(start, end - 1):
507 if is_twin_prime(num, num + 2):
508 twin_primes.append((num, num + 2))
509 return twin_primes
510 # Example usage
511 print(generate_twin_primes(10, 30)) # Expected output: [(11, 13), (17, 19)]
512
PROBLEMS OUTPUT TERMINAL PORTS DEBUG CONSOLE
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC> & C:/Users/hruth/AppData/Local/Programs/Python/Python312/python.
[(11, 13), (17, 19)]
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC>

Task 10 – Refactoring the Chinese Zodiac Program

Objective

Refactor the given poorly structured Python script into a clean, modular, and reusable implementation.
The current program reads a year from the user and prints the corresponding Chinese Zodiac sign.
However, the implementation contains repetitive conditional logic, lacks modular design, and does not follow clean coding principles.
Your task is to refactor the code to improve readability, maintainability, and structure.

Chinese Zodiac Cycle (Repeats Every 12 Years)

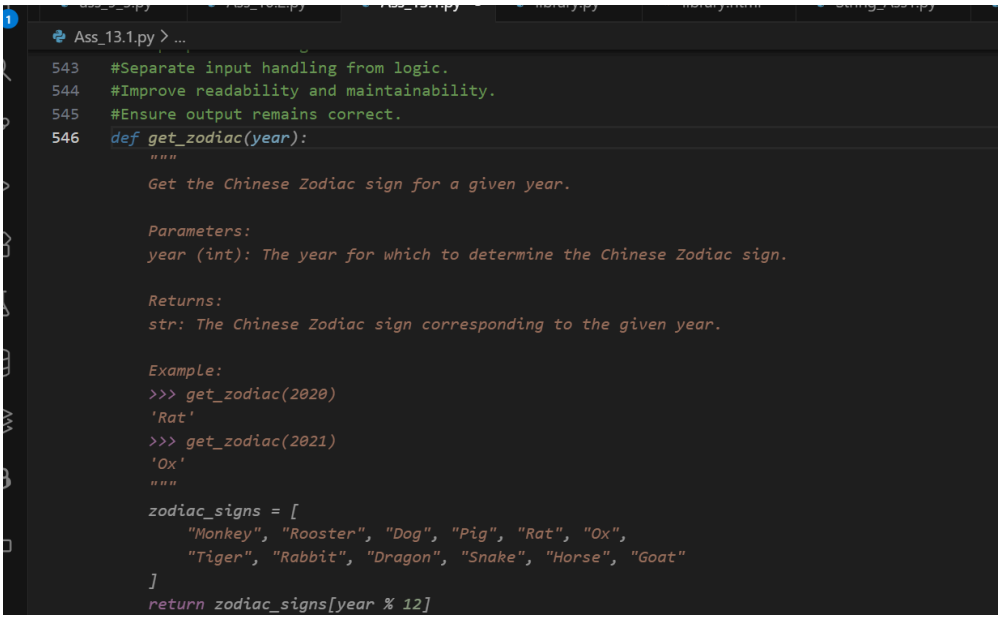
1. Rat
2. Ox
3. Tiger
4. Rabbit
5. Dragon
6. Snake
7. Horse
8. Goat (Sheep)
9. Monkey
10. Rooster
11. Dog
12. Pig

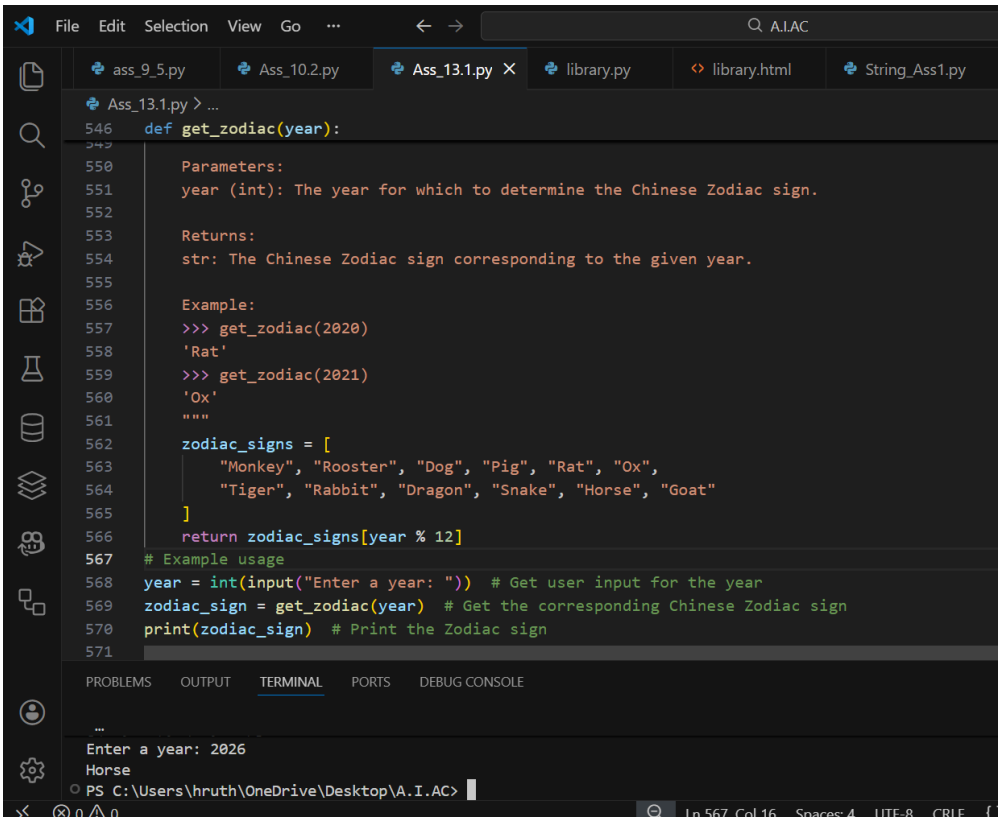
```
# Chinese Zodiac Program (Unstructured Version)
# This code needs refactoring.
year = int(input("Enter a year: "))
if year % 12 == 0:
print("Monkey")
elif year % 12 == 1:
print("Rooster")
elif year % 12 == 2:
print("Dog")
elif year % 12 == 3:
print("Pig")
elif year % 12 == 4:
print("Rat")
elif year % 12 == 5:
print("Ox")
elif year % 12 == 6:
print("Tiger")
elif year % 12 == 7:
print("Rabbit")
elif year % 12 == 8:
print("Dragon")
elif year % 12 == 9:
print("Snake")
elif year % 12 == 10:
print("Horse")
```

elif year % 12 == 11:
print("Goat")

You must:

1. Create a reusable function: get_zodiac(year)
2. Replace the if-elif chain with a cleaner structure (e.g., list or dictionary).
3. Add proper docstrings.
4. Separate input handling from logic.
5. Improve readability and maintainability.
6. Ensure output remains correct.




File Edit Selection View Go
A.I.AC
ass_9_5.py
Ass_10.2.py
Ass_13.1.py
library.py
library.html
String_Ass1.py
Ass_13.1.py > ...
def get_zodiac(year):
Parameters:
year (int): The year for which to determine the Chinese Zodiac sign.
Returns:
str: The Chinese Zodiac sign corresponding to the given year.
Example:
>>> get_zodiac(2020)
'Rat'
>>> get_zodiac(2021)
'Ox'
"""
zodiac_signs = [
"Monkey", "Rooster", "Dog", "Pig", "Rat", "Ox",
"Tiger", "Rabbit", "Dragon", "Snake", "Horse", "Goat"
]
return zodiac_signs[year % 12]
# Example usage
year = int(input("Enter a year: ")) # Get user input for the year
zodiac_sign = get_zodiac(year) # Get the corresponding Chinese Zodiac sign
print(zodiac_sign) # Print the Zodiac sign
PROBLEMS
OUTPUT
TERMINAL
PORTS
DEBUG CONSOLE
Enter a year: 2026
Horse
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC>

💡 **Task 11 – Refactoring the Harshad (Niven) Number Checker**
Refactor the given poorly structured Python script into a clean, modular, and reusable implementation.
A Harshad (Niven) number is a number that is divisible by the sum of its digits.**For example:**

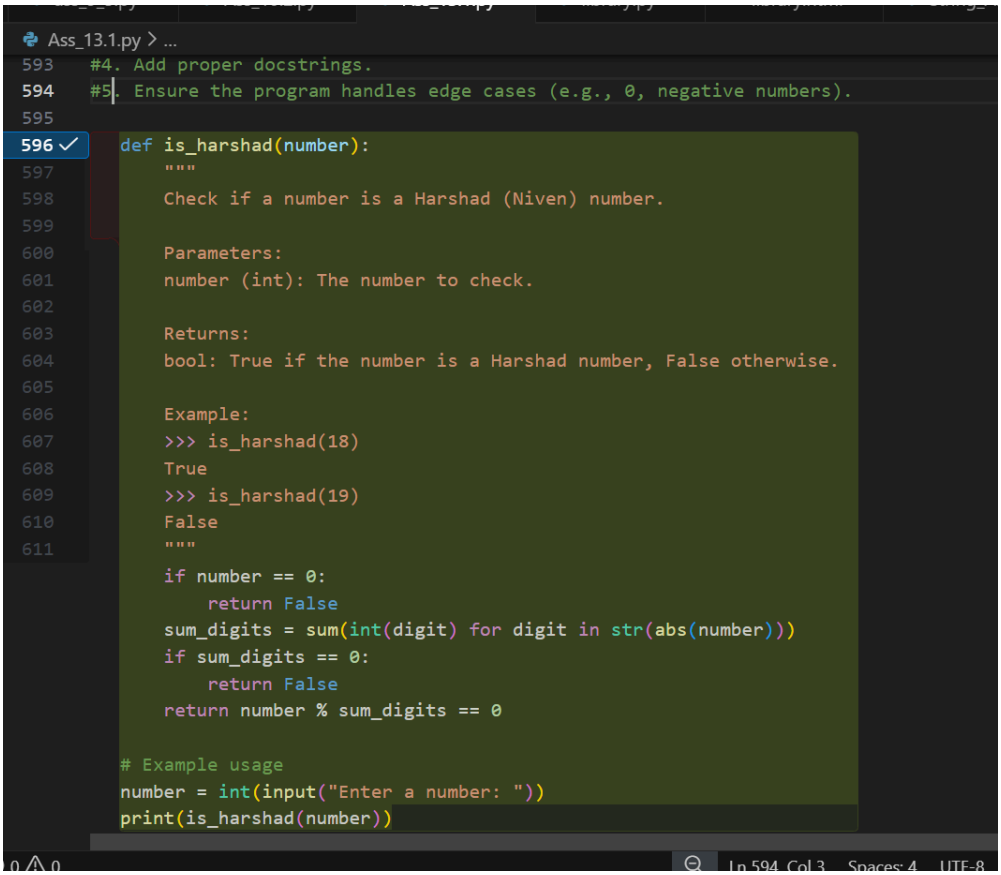
- **18 → 1 + 8 = 9 → 18 ÷ 9 = 2 ✅ (Harshad Number)**
- **19 → 1 + 9 = 10 → 19 ÷ 10 ≠ integer ❌ (Not Harshad)**

Problem Statement
The current implementation:

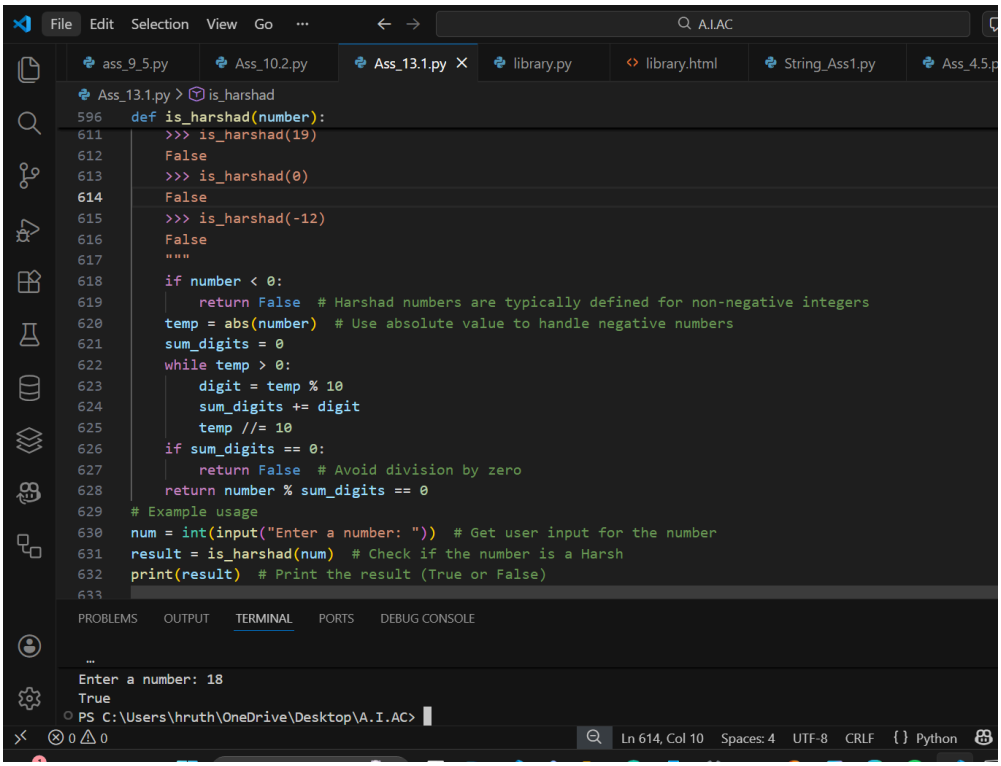
- Mixes logic and input handling
- Uses redundant variables
- Does not use reusable functions properly
- Returns print statements instead of boolean values
- Lacks documentation

You must refactor the code to follow clean coding principles.
# Harshad Number Checker (Unstructured Version)
num = int(input("Enter a number: "))
temp = num
sum_digits = 0
while temp > 0:
digit = temp % 10
sum_digits = sum_digits + digit
temp = temp // 10
if sum_digits != 0:
if num % sum_digits == 0:
print("True")
else:
print("False")
else:
print("False")
You must:

1. Create a reusable function: is_harshad(number)
2. The function must:
    - Accept an integer parameter.
    - Return True if the number is divisible by the sum of its digits.
    - Return False otherwise.
3. Separate user input from core logic.
4. Add proper docstrings.
5. Improve readability and maintainability.
6. Ensure the program handles edge cases (e.g., 0, negative numbers).



```
Ass_13.1.py > ...
593  #4. Add proper docstrings.
594  #5. Ensure the program handles edge cases (e.g., 0, negative numbers).
595
596  def is_harshad(number):
597      """
598      Check if a number is a Harshad (Niven) number.
599
600      Parameters:
601      number (int): The number to check.
602
603      Returns:
604      bool: True if the number is a Harshad number, False otherwise.
605
606      Example:
607      >>> is_harshad(18)
608      True
609      >>> is_harshad(19)
610      False
611      """
         if number == 0:
             return False
         sum_digits = sum(int(digit) for digit in str(abs(number)))
         if sum_digits == 0:
             return False
         return number % sum_digits == 0

     # Example usage
     number = int(input("Enter a number: "))
     print(is_harshad(number))
```



```
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ass_9_5.py | Ass_10.2.py | Ass_13.1.py | library.py | library.html | String_Ass1.py | Ass_4.5.p

Ass_13.1.py > is_harshad
596  def is_harshad(number):
611      >>> is_harshad(19)
612      False
613      >>> is_harshad(0)
614      False
615      >>> is_harshad(-12)
616      False
617      """
618      if number < 0:
619          return False  # Harshad numbers are typically defined for non-negative integers
620      temp = abs(number)  # Use absolute value to handle negative numbers
621      sum_digits = 0
622      while temp > 0:
623          digit = temp % 10
624          sum_digits += digit
625          temp //= 10
626      if sum_digits == 0:
627          return False  # Avoid division by zero
628      return number % sum_digits == 0
629  # Example usage
630  num = int(input("Enter a number: "))  # Get user input for the number
631  result = is_harshad(num)  # Check if the number is a Harsh
632  print(result)  # Print the result (True or False)
633

PROBLEMS  OUTPUT  TERMINAL  PORTS  DEBUG CONSOLE

...
Enter a number: 18
True
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC>

⊗ 0 ⚠ 0   Ln 614, Col 10  Spaces: 4  UTF-8  CRLF  { } Python
```

Task 12 – Refactoring the Factorial Trailing Zeros Program
Refactor the given poorly structured Python script into a clean, modular, and efficient implementation.
The program calculates the number of trailing zeros in n! (factorial of n).
Problem Statement
The current implementation:

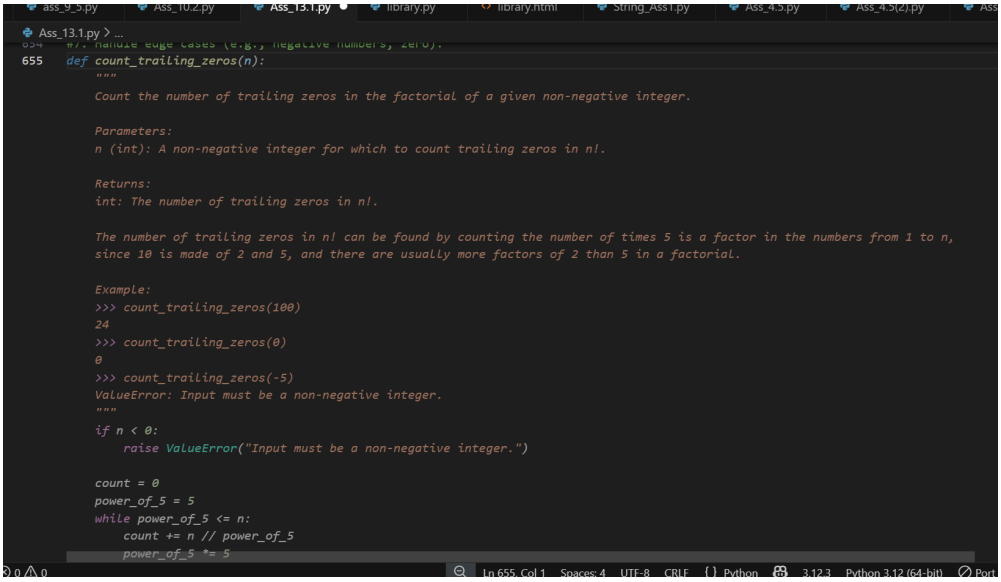
- Calculates the full factorial (inefficient for large n)
- Mixes input handling with business logic
- Uses print statements instead of return values
- Lacks modular structure and documentation

You must refactor the code to improve efficiency, readability, and maintainability.
 # Factorial Trailing Zeros (Unstructured Version)

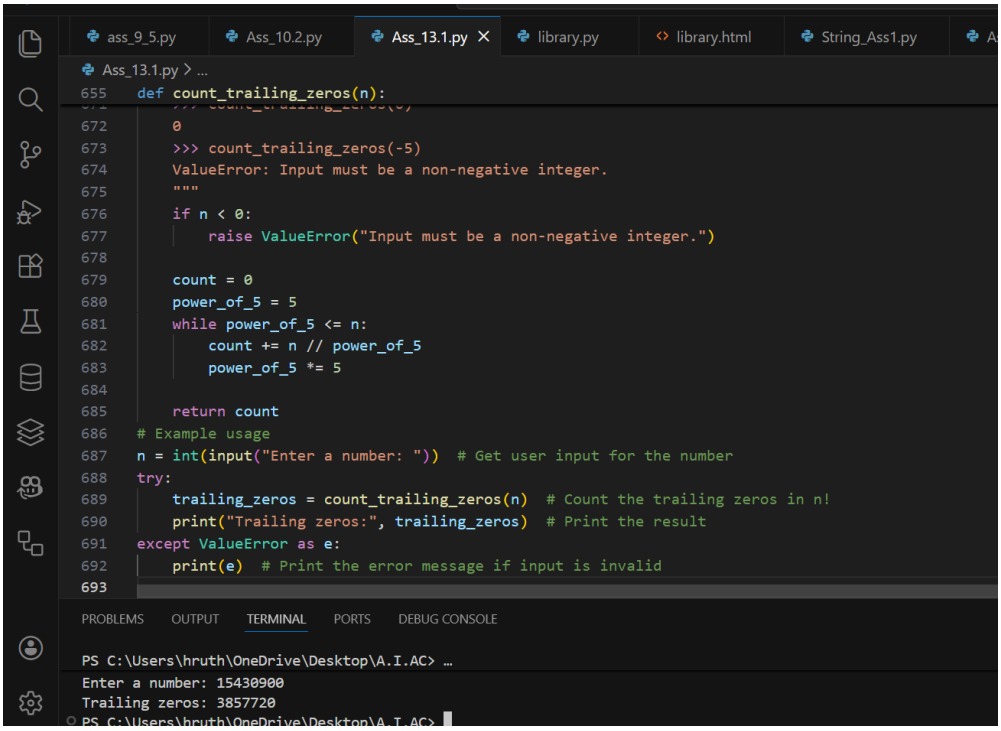
```
n = int(input("Enter a number: "))
fact = 1
i = 1
while i <= n:
fact = fact * i
i = i + 1
count = 0
while fact % 10 == 0:
count = count + 1
fact = fact // 10
print("Trailing zeros:", count)
```

You must:

1. Create a reusable function: count_trailing_zeros(n)
2. The function must:
    - Accept a non-negative integer n.
    - Return the number of trailing zeros in **n!**.
3. Do NOT compute the full factorial.
4. Use an optimized mathematical approach (count multiples of 5).
5. Add proper docstrings.
6. Separate user interaction from core logic.
7. Handle edge cases (e.g., negative numbers, zero).



```
def count_trailing_zeros(n):
    """
    Count the number of trailing zeros in the factorial of a given non-negative integer.

    Parameters:
    n (int): A non-negative integer for which to count trailing zeros in n!.

    Returns:
    int: The number of trailing zeros in n!.

    The number of trailing zeros in n! can be found by counting the number of times 5 is a factor in the numbers from 1 to n,
    since 10 is made of 2 and 5, and there are usually more factors of 2 than 5 in a factorial.

    Example:
    >>> count_trailing_zeros(100)
    24
    >>> count_trailing_zeros(0)
    0
    >>> count_trailing_zeros(-5)
    ValueError: Input must be a non-negative integer.
    """
    if n < 0:
        raise ValueError("Input must be a non-negative integer.")

    count = 0
    power_of_5 = 5
    while power_of_5 <= n:
        count += n // power_of_5
        power_of_5 *= 5
```



```
def count_trailing_zeros(n):
    0
    >>> count_trailing_zeros(-5)
    ValueError: Input must be a non-negative integer.
    """
    if n < 0:
        raise ValueError("Input must be a non-negative integer.")

    count = 0
    power_of_5 = 5
    while power_of_5 <= n:
        count += n // power_of_5
        power_of_5 *= 5

    return count
# Example usage
n = int(input("Enter a number: "))  # Get user input for the number
try:
    trailing_zeros = count_trailing_zeros(n)  # Count the trailing zeros in n!
    print("Trailing zeros:", trailing_zeros)  # Print the result
except ValueError as e:
    print(e)  # Print the error message if input is invalid
```

```
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC> …
Enter a number: 15430900
Trailing zeros: 3857720
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC>
```

Test Cases Design
Task 13 (Collatz Sequence Generator – Test Case Design)

- Function: Generate Collatz sequence until reaching 1.Test Cases to Design:
- Normal: 6 → [6,3,10,5,16,8,4,2,1]
- Edge: 1 → [1]
- Negative: -5
- Large: 27 (well-known long sequence) Requirement: Validate correctness with pytest.

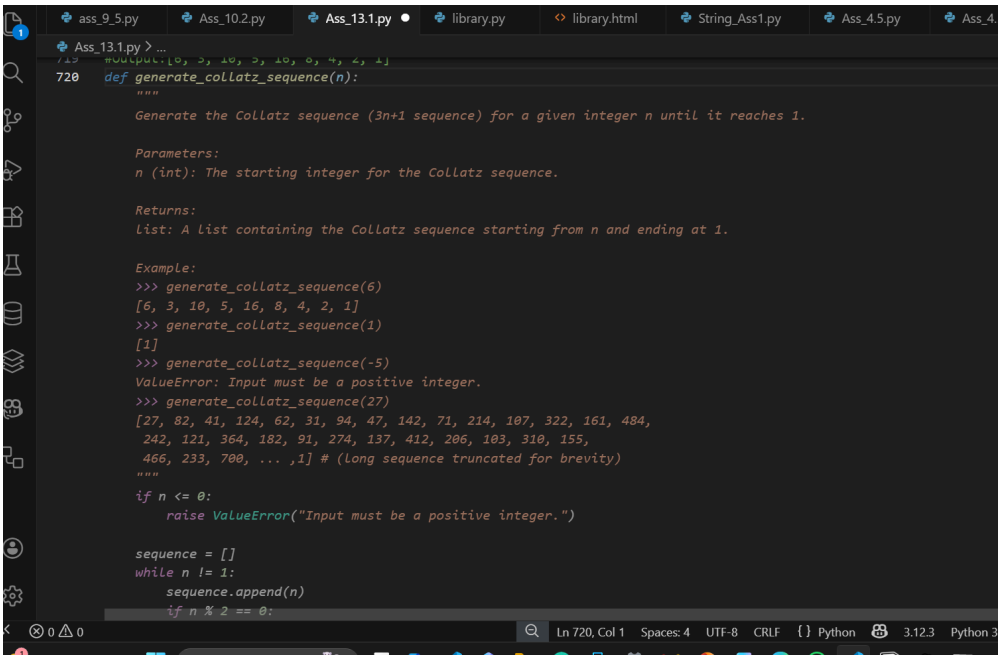
Explanation:
We need to write a function that:

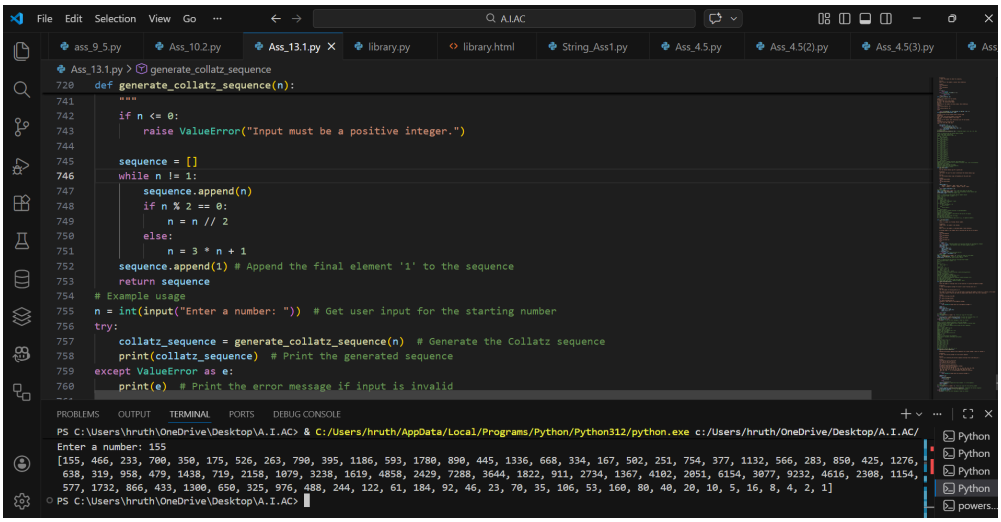
- Takes an integer n as input.
- Generates the Collatz sequence (also called the 3n+1 sequence).
- The rules are:
  - If n is even → next = n / 2.
  - If n is odd → next = 3n + 1.
- Repeat until we reach 1.
- Return the full sequence as a list.

Example
Input: 6
Steps:

- 6 (even → 6/2 = 3)
- 3 (odd → 3*3+1 = 10)
- 10 (even → 10/2 = 5)
- 5 (odd → 3*5+1 = 16)
- 16 (even → 16/2 = 8)
- 8 (even → 8/2 = 4)
- 4 (even → 4/2 = 2)
- 2 (even → 2/2 = 1)

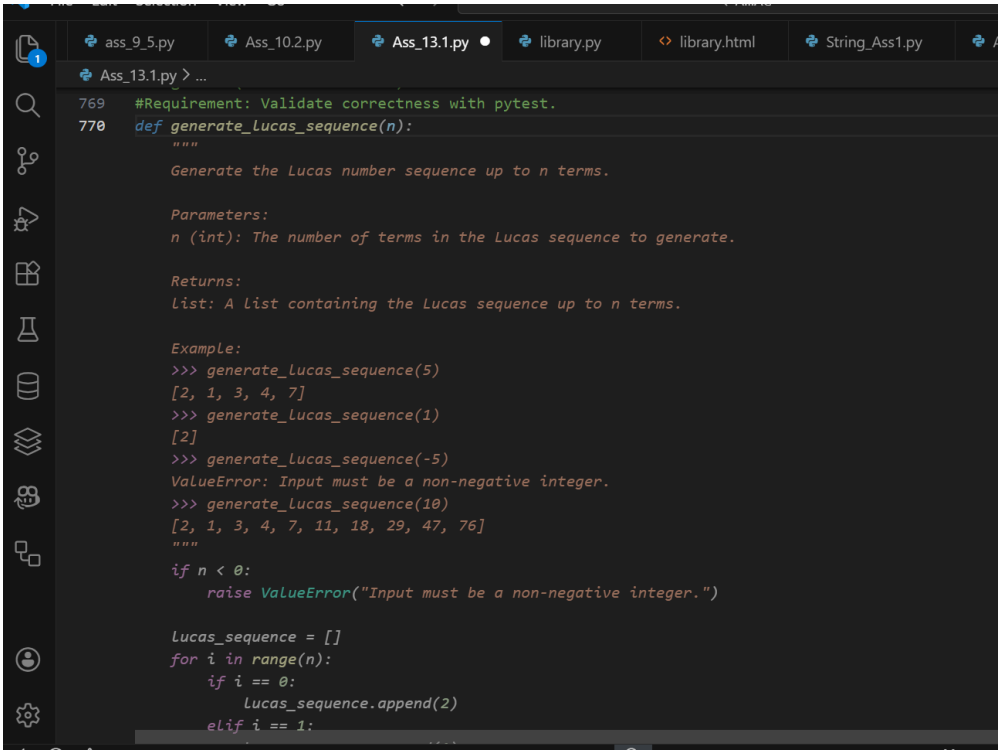
Output:
[6, 3, 10, 5, 16, 8, 4, 2, 1]

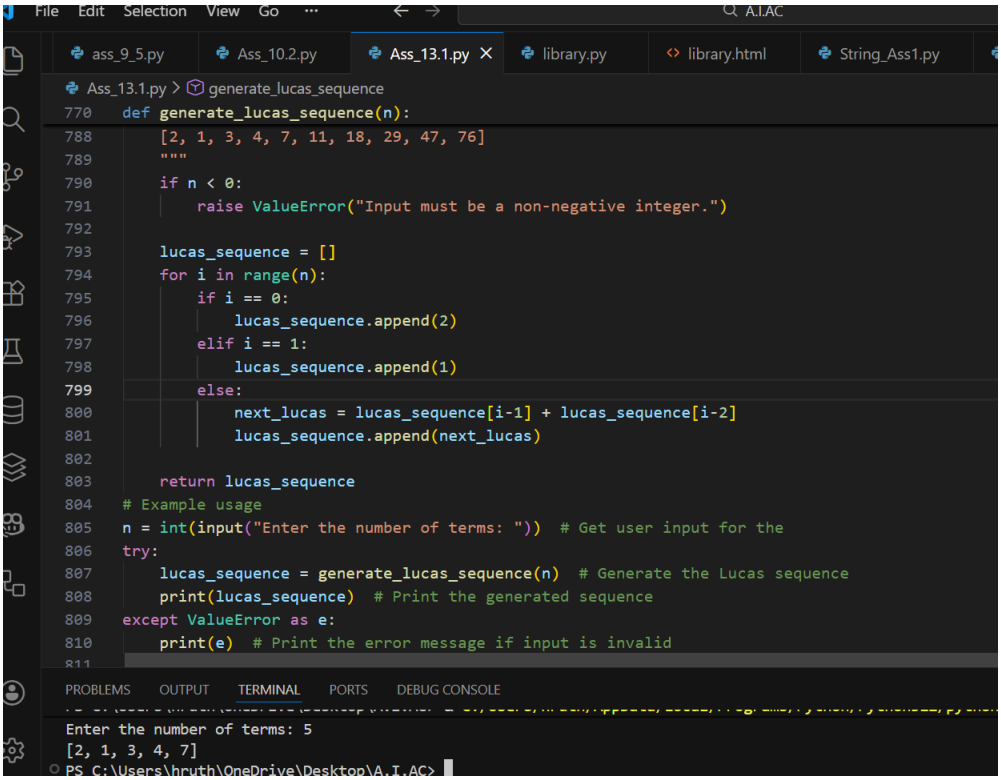




Task 14 (Lucas Number Sequence – Test Case Design)

- Function: Generate Lucas sequence up to n terms.(Starts with 2,1, then Fn = Fn-1 + Fn-2)Test Cases to Design:
- Normal: 5 → [2, 1, 3, 4, 7]
- Edge: 1 → [2]
- Negative: -5 → Error
- Large: 10 (last element = 76). Requirement: Validate correctness with pytest.


ass_9_5.py
Ass_10.2.py
Ass_13.1.py
library.py
library.html
String_Ass1.py
Ass_13.1.py > ...
769 #Requirement: Validate correctness with pytest.
770 def generate_lucas_sequence(n):
"""
Generate the Lucas number sequence up to n terms.
Parameters:
n (int): The number of terms in the Lucas sequence to generate.
Returns:
List: A List containing the Lucas sequence up to n terms.
Example:
>>> generate_lucas_sequence(5)
[2, 1, 3, 4, 7]
>>> generate_lucas_sequence(1)
[2]
>>> generate_lucas_sequence(-5)
ValueError: Input must be a non-negative integer.
>>> generate_lucas_sequence(10)
[2, 1, 3, 4, 7, 11, 18, 29, 47, 76]
"""
if n < 0:
raise ValueError("Input must be a non-negative integer.")
lucas_sequence = []
for i in range(n):
if i == 0:
lucas_sequence.append(2)
elif i == 1:

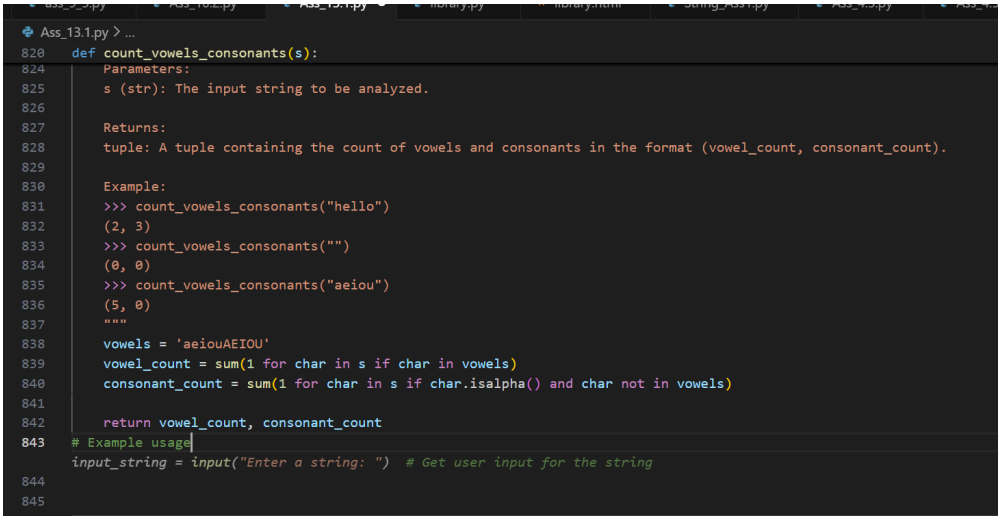

File Edit Selection View Go
A.I.AC
ass_9_5.py
Ass_10.2.py
Ass_13.1.py
library.py
library.html
String_Ass1.py
Ass_13.1.py > generate_lucas_sequence
770 def generate_lucas_sequence(n):
788 [2, 1, 3, 4, 7, 11, 18, 29, 47, 76]
789 """
790 if n < 0:
791 raise ValueError("Input must be a non-negative integer.")
792
793 lucas_sequence = []
794 for i in range(n):
795 if i == 0:
796 lucas_sequence.append(2)
797 elif i == 1:
798 lucas_sequence.append(1)
799 else:
800 next_lucas = lucas_sequence[i-1] + lucas_sequence[i-2]
801 lucas_sequence.append(next_lucas)
802
803 return lucas_sequence
804 # Example usage
805 n = int(input("Enter the number of terms: ")) # Get user input for the
806 try:
807 lucas_sequence = generate_lucas_sequence(n) # Generate the Lucas sequence
808 print(lucas_sequence) # Print the generated sequence
809 except ValueError as e:
810 print(e) # Print the error message if input is invalid
PROBLEMS
OUTPUT
TERMINAL
PORTS
DEBUG CONSOLE
Enter the number of terms: 5
[2, 1, 3, 4, 7]
PS C:\Users\hruth\OneDrive\Desktop\A.I.AC>

Task 15 (Vowel & Consonant Counter – Test Case Design)

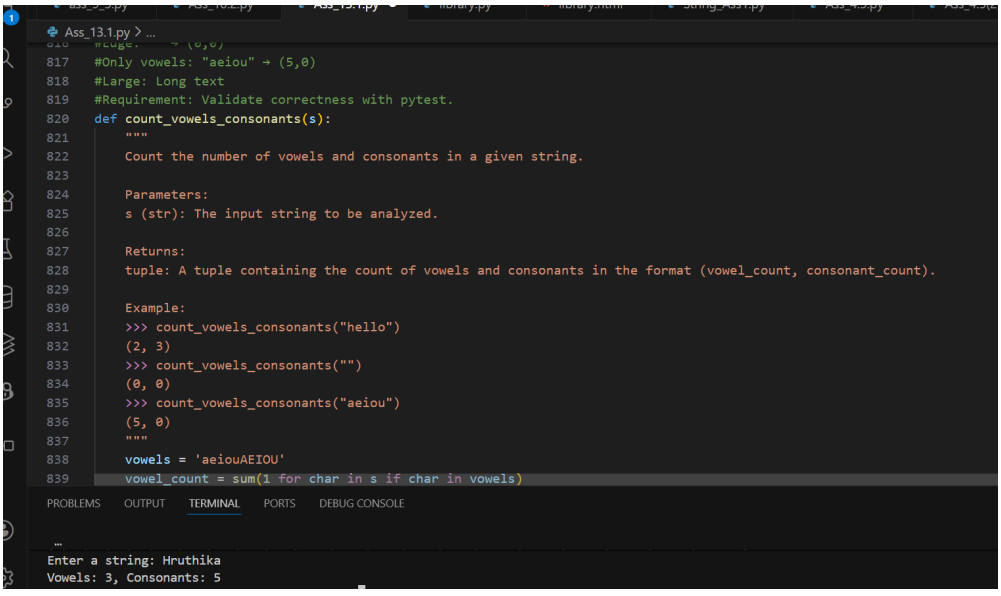
- Function: Count vowels and consonants in string.Test Cases to Design:
- Normal: "hello" → (2,3)
- Edge: "" → (0,0)
- Only vowels: "aeiou" → (5,0)

Large: Long text

- Requirement: Validate correctness with pytest



```
Ass_13.1.py > ...
820  def count_vowels_consonants(s):
824      Parameters:
825      s (str): The input string to be analyzed.
826
827      Returns:
828      tuple: A tuple containing the count of vowels and consonants in the format (vowel_count, consonant_count).
829
830      Example:
831      >>> count_vowels_consonants("hello")
832      (2, 3)
833      >>> count_vowels_consonants("")
834      (0, 0)
835      >>> count_vowels_consonants("aeiou")
836      (5, 0)
837      """
838      vowels = 'aeiouAEIOU'
839      vowel_count = sum(1 for char in s if char in vowels)
840      consonant_count = sum(1 for char in s if char.isalpha() and char not in vowels)
841
842      return vowel_count, consonant_count
843  # Example usage
     input_string = input("Enter a string: ")  # Get user input for the string
844
845
```



```
Ass_13.1.py > ...
817  #Only vowels: "aeiou" → (5,0)
818  #Large: Long text
819  #Requirement: Validate correctness with pytest.
820  def count_vowels_consonants(s):
821      """
822      Count the number of vowels and consonants in a given string.
823
824      Parameters:
825      s (str): The input string to be analyzed.
826
827      Returns:
828      tuple: A tuple containing the count of vowels and consonants in the format (vowel_count, consonant_count).
829
830      Example:
831      >>> count_vowels_consonants("hello")
832      (2, 3)
833      >>> count_vowels_consonants("")
834      (0, 0)
835      >>> count_vowels_consonants("aeiou")
836      (5, 0)
837      """
838      vowels = 'aeiouAEIOU'
839      vowel_count = sum(1 for char in s if char in vowels)

PROBLEMS  OUTPUT  TERMINAL  PORTS  DEBUG CONSOLE

Enter a string: Hruthika
Vowels: 3, Consonants: 5
```