

## Ai Assisted Coding

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### Lab 10.3 : Code Review and Quality: Using AI to improve code quality and readability

#### Problem Statement 1: AI-Assisted Bug Detection :

**Scenario:** A junior developer wrote the following Python function to calculate factorials:

```
def factorial(n):  
    result = 1  
    for i in range(1, n):  
        result = result * i  
    return result
```

#### Instructions:

1. Run the code and test it with factorial(5).
2. Use an AI assistant to:
  - o Identify the logical bug in the code.
  - o Explain why the bug occurs (e.g., off-by-one error).
  - o Provide a corrected version.
3. Compare the AI's corrected code with your own manual fix.
4. Write a brief comparison: Did AI miss any edge cases (e.g., negative numbers, zero)?

Expected Output:

Corrected function should return 120 for factorial(5).

#### 1) Original Code :

```
def factorial(n):  
    result = 1  
    for i in range(1, n):  
        result = result * i  
    return result  
print(factorial(5))
```

#### 2) Manual Review :

- Loop runs from 1 to n-1
- Missing multiplication by n
- Does not handle:
  - o n = 0
  - o negative numbers

### 3) AI Prompt Used :

*Identify the logical bug in this factorial function.*

*Explain why it occurs and provide a corrected version.*

*Also consider edge cases like zero and negative numbers.*

### 4) AI Improved Code :

```
def factorial(n):
```

```
    if n < 0:
```

```
        raise ValueError("Factorial not defined for negative numbers.")
```

```
    result = 1
```

```
    for i in range(1, n + 1):
```

```
        result *= i
```

```
    return result
```

```
print(factorial(5))
```

```
print(factorial(0))
```

### 5) Output :

120

1

### 6) Comparison :

Feature	Original	Improved
Loop Range	Wrong	Correct
Zero Handling	No	Yes
Negative Handling	No	Yes
Correct Output	No	Yes

### 7) Explanation :

AI correctly identified the off-by-one error and improved edge case handling. It enhanced correctness and robustness.

```
lab10.3 > task01.py X task02.py task03.py task04.py task05.py
1 #original code :
2 def factorial(n):
3     result = 1
4     for i in range(1, n):
5         result = result * i
6     return result
7
8 print(factorial(5))
9
10 #AI Prompt Used :
11
12 # Identify the logical bug in this factorial function.
13 # Explain why it occurs and provide a corrected version.
14 # Also consider edge cases like zero and negative numbers.
15 def factorial(n):
16     if n < 0:
17         raise ValueError("Factorial is not defined for negative numbers.")
18     elif n == 0:
19         return 1
20     else:
21         result = 1
22         for i in range(1, n + 1):
23             result = result * i
24         return result
25
26 print(factorial(5)) # Expected output: 120
27 print(factorial(0)) # Expected output: 1
28 try:
29     print(factorial(-1)) # Expected to raise ValueError
30 except ValueError as e:
31     print(e) # Output: Factorial is not defined for negative numbers.
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
anumandlarithika@Mac AI_Assisted_lab % /usr/bin/python3 /Users/anumandlarithika/SRU/AI_Assisted_lab/lab10.3/task01.py
24
120
1
Factorial is not defined for negative numbers.
anumandlarithika@Mac AI_Assisted_lab %
```

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## Problem Statement 2: Task 2 — Improving Readability & Documentation

**Scenario:** The following code works but is poorly written:

```
def calc(a, b, c):
    if c == "add":
        return a + b
    elif c == "sub":
        return a - b
    elif c == "mul":
        return a * b
    elif c == "div":
```

### Instructions:

5. Use AI to:

- o Critique the function's readability, parameter naming, and lack of documentation.
- o Rewrite the function with:
  1. Descriptive function and parameter names.
  2. A complete docstring (description, parameters, return value, examples).
  3. Exception handling for division by zero.
  4. Consideration of input validation.
- 6. Compare the original and AI-improved versions.
- 7. Test both with valid and invalid inputs (e.g., division by zero, non-string operation).

**Expected Output:**

A well-documented, robust, and readable function that handles errors gracefully.

### 1) Original Code :

```
def calc(a, b, c):  
    if c == "add":  
        return a + b  
    elif c == "sub":  
        return a - b  
    elif c == "mul":  
        return a * b  
    elif c == "div":  
        return a / b
```

### 2) Manual Review :

- Poor naming
- No documentation
- No error handling
- No input validation

### 3) AI Prompt :

*Improve readability, naming, documentation and add error handling.*

### 4) AI Improved Code :

```
def calculate(number1: float, number2: float, operation: str) -> float:  
    """  
    Performs arithmetic operations.  
    """  
  
    if not isinstance(operation, str):  
        raise TypeError("Operation must be a string.")  
  
    if operation == "add":  
        return number1 + number2  
    elif operation == "sub":  
        return number1 - number2  
    elif operation == "mul":  
        return number1 * number2  
    elif operation == "div":  
        if number2 == 0:
```

```

        raise ZeroDivisionError("Cannot divide by zero.")
    return number1 / number2
else:
    raise ValueError("Invalid operation.")

```

## 5) Output :

15  
ZeroDivisionError

## 6) Comparison :

Feature	Original	Improved
Naming	Poor	Clear
Documentation	No	Yes
Error Handling	No	Yes
Validation	No	Yes

## 7) Reflection :

AI significantly improved readability and robustness.

```

lab10.3 > task02.py > calc
1 def calc(a, b, c):
2     if c == "add":
3         return a + b
4     elif c == "sub":
5         return a - b
6     elif c == "mul":
7         return a * b
8     elif c == "div":
9         return a / b
10    else:
11        raise ValueError("Invalid operation")
12    print(calc(10, 5, "add")) # Expected output: 15
13    print(calc(10, 5, "sub")) # Expected output: 5
14    print(calc(10, 5, "mul")) # Expected output: 50
15    print(calc(10, 5, "div")) # Expected output: 2.
16    print(calc(10, 5, "mod")) # Expected to raise ValueError
17
18    #AI prompt used :
19    # Improve readability, naming, documentation and add error handling.
20    def calculate(a: float, b: float, operation: str) -> float:
21        """
22        Perform a basic arithmetic operation on two numbers.
23
24        Parameters:
25        a (float): The first number.
26        b (float): The second number.
27        operation (str): The operation to perform ('add', 'sub', 'mul', 'div').
28
29        Returns:
30        float: The result of the arithmetic operation.
31        """
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```

```

Python
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Python 3.9.6

```

```

anumandlarithika@Mac AI_Assisted_lab % /usr/bin/python3 /Users/anumandlarithika/SRU/AI_Assisted_lab/lab10.3/task02.py
15
5
50
2.0
Traceback (most recent call last):
  File "/Users/anumandlarithika/SRU/AI_Assisted_lab/lab10.3/task02.py", line 16, in <module>
    print(calc(10, 5, "mod")) # Expected to raise ValueError
  File "/Users/anumandlarithika/SRU/AI_Assisted_lab/lab10.3/task02.py", line 11, in calc
    raise ValueError("Invalid operation")
ValueError: Invalid operation
anumandlarithika@Mac AI_Assisted_lab %

```

## Problem Statement 3: Enforcing Coding Standards

**Scenario:** A team project requires PEP8 compliance. A developer submits:

```

def Checkprime(n):
for i in range(2, n):

```

```
if n % i == 0:
```

```
    return False
```

```
    return True
```

Instructions:

8. Verify the function works correctly for sample inputs.

9. Use an AI tool (e.g., ChatGPT, GitHub Copilot, or a PEP8 linter with AI explanation) to:

- o List all PEP8 violations.

- o Refactor the code (function name, spacing, indentation, naming).

10. Apply the AI-suggested changes and verify functionality is preserved.

11. Write a short note on how automated AI reviews could streamline code reviews in large teams.

Expected Output:

A PEP8-compliant version of the function, e.g.:

```
def check_prime(n):
```

```
    for i in range(2, n):
```

```
        if n % i == 0:
```

```
            return False
```

```
    return True
```

### 1) Original Code :

```
def Checkprime(n):
```

```
    for i in range(2, n):
```

```
        if n % i == 0:
```

```
            return False
```

```
    return True
```

### 2) Manual Review :

- Function name not snake\_case
- No docstring
- No type hints
- No edge case handling

### 3 ) AI Prompt :

List PEP8 violations and refactor this function.

### 4) AI Improved Code :

```
def check_prime(n: int) -> bool:
```

```
    """
```

```
    Checks whether a number is prime.
```

"""

```
if n < 2:
    return False
```

```
for i in range(2, n):
    if n % i == 0:
        return False
return True
```

## 5) Output :

True

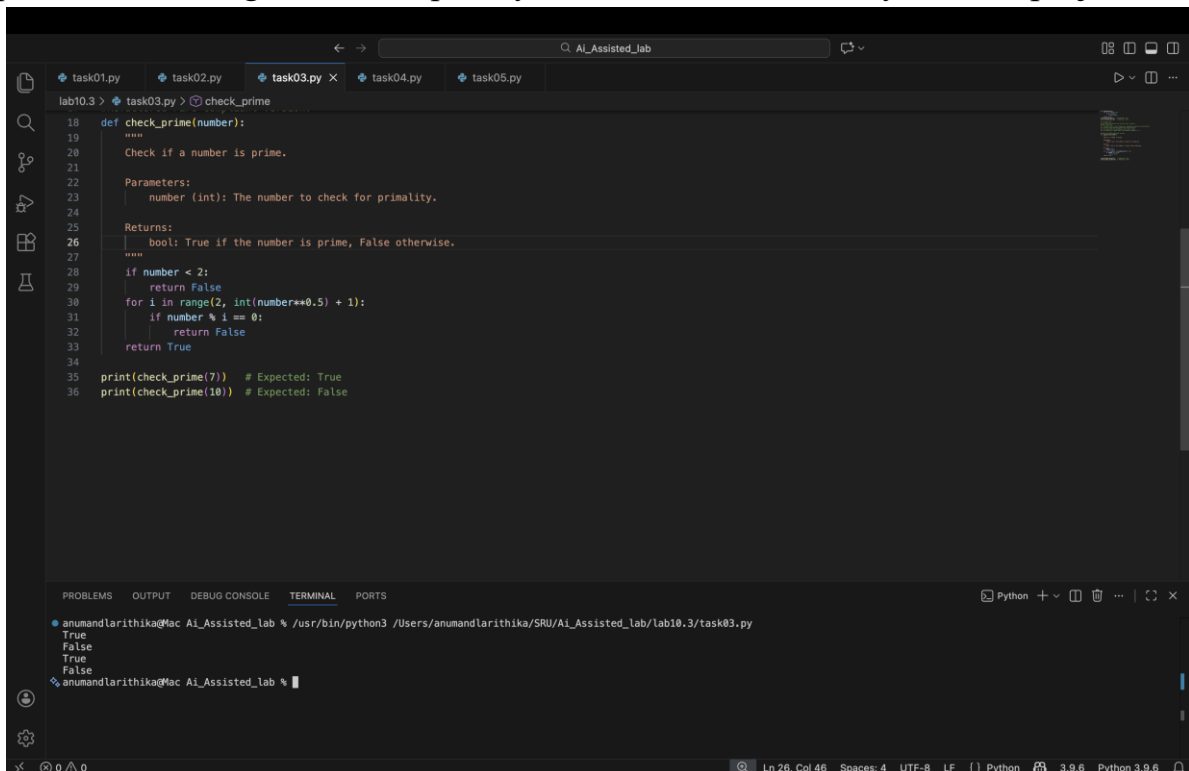
False

## 6) Comparison :

Feature	Original	Improved
Naming	Not PEP8	PEP8 compliant
Docstring	No	Yes
Edge Cases	No	Yes

## 7) Reflection :

AI helps enforce coding standards quickly and ensures consistency in team projects.



```
def check_prime(number):
    """
    Check if a number is prime.

    Parameters:
        number (int): The number to check for primality.

    Returns:
        bool: True if the number is prime, False otherwise.
    """
    if number < 2:
        return False
    for i in range(2, int(number**0.5) + 1):
        if number % i == 0:
            return False
    return True

print(check_prime(7)) # Expected: True
print(check_prime(10)) # Expected: False
```

```
anumandlarithika@Mac Ai_Assisted_lab % /usr/bin/python3 /Users/anumandlarithika/SRU/Ai_Assisted_lab/lab10.3/task03.py
True
False
True
False
anumandlarithika@Mac Ai_Assisted_lab %
```

## Problem Statement 4: AI as a Code Reviewer in Real Projects

### Scenario:

In a GitHub project, a teammate submits:

```
def processData(d):  
    return [x * 2 for x in d if x % 2 == 0]
```

### **Instructions:**

1. Manually review the function for:
  - o Readability and naming.
  - o Reusability and modularity.
  - o Edge cases (non-list input, empty list, non-integer elements).
2. Use AI to generate a code review covering:
  - a. Better naming and function purpose clarity.
  - b. Input validation and type hints.
  - c. Suggestions for generalization (e.g., configurable multiplier).
3. Refactor the function based on AI feedback.
4. Write a short reflection on whether AI should be a standalone reviewer or an assistant.

### **Expected Output:**

An improved function with type hints, validation, and clearer intent,  
e.g.:

```
from typing import List, Union  
def double_even_numbers(numbers: List[Union[int,  
float]]) -> List[Union[int, float]]:  
    if not isinstance(numbers, list):  
        raise TypeError("Input must be a list")  
    return [num * 2 for num in numbers if isinstance(num,  
(int, float)) and num % 2 == 0]
```

### **1) Original Code :**

```
def processData(d):  
    return [x * 2 for x in d if x % 2 == 0]
```

### **2) Manual Review :**

- Poor naming
- No validation
- No type hints
- Crashes for mixed types
- Not reusable

### **3) AI Prompt :**

Review this function for readability, modularity, edge cases, validation and suggest improvements.



#### 4) AI Improved Code :

from typing import List, Union

```
def process_data(  
    data: List[Union[int, float]],  
    multiplier: Union[int, float] = 2  
) -> List[Union[int, float]]:  
  
    if not isinstance(data, list):  
        raise TypeError("Input must be a list.")  
  
    return [  
        x * multiplier  
        for x in data  
        if isinstance(x, (int, float)) and x % 2 == 0  
    ]  
print(process_data([1,2,3,4,5,6]))  
print(process_data([1,2,3,4],3))  
print(process_data([]))  
print(process_data([2,"a",4]))
```

#### 5) Output :

[4, 8, 12]

[6, 12]

[]

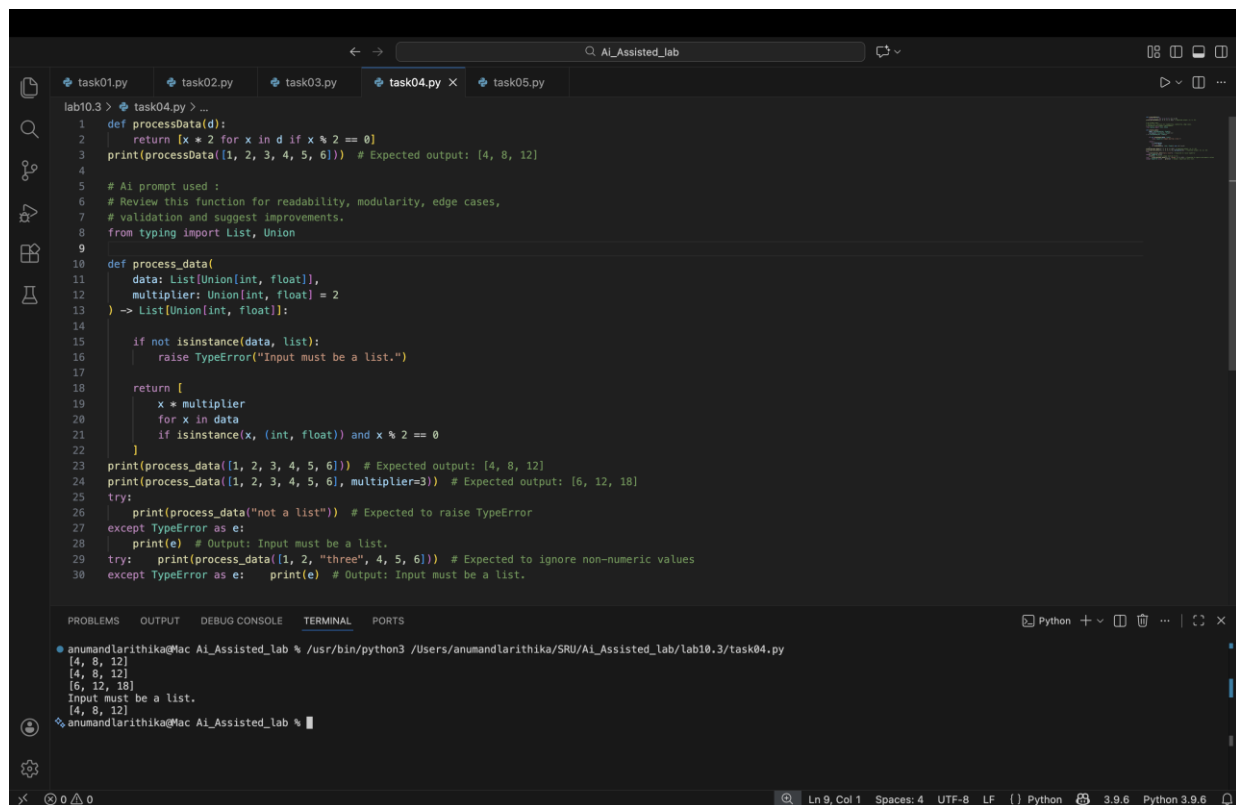
[4, 8]

#### 7) Comparison :

Feature	Original	Improved
Naming	Poor	Clear
Validation	No	Yes
Reusability	No	Yes
Type Safety	No	Yes

#### 8) Reflection :

AI is best used as an assistant reviewer. It efficiently improves structure and quality, but human oversight remains necessary for logical and architectural decisions.



```
lab10.3 > task04.py > ...
1 def process_data(d):
2     return [x * 2 for x in d if x % 2 == 0]
3     print(process_data([1, 2, 3, 4, 5, 6])) # Expected output: [4, 8, 12]
4
5 # AI prompt used :
6 # Review this function for readability, modularity, edge cases,
7 # validation and suggest improvements.
8 from typing import List, Union
9
10 def process_data(
11     data: List[Union[int, float]],
12     multiplier: Union[int, float] = 2
13 ) -> List[Union[int, float]]:
14
15     if not isinstance(data, list):
16         raise TypeError("Input must be a list.")
17
18     return [
19         x * multiplier
20         for x in data
21         if isinstance(x, (int, float)) and x % 2 == 0
22     ]
23
24 print(process_data([1, 2, 3, 4, 5, 6])) # Expected output: [4, 8, 12]
25 print(process_data([1, 2, 3, 4, 5, 6], multiplier=3)) # Expected output: [6, 12, 18]
26 try:
27     print(process_data("not a list")) # Expected to raise TypeError
28 except TypeError as e:
29     print(e) # Output: Input must be a list.
30 try:
31     print(process_data([1, 2, "three", 4, 5, 6])) # Expected to ignore non-numeric values
32 except TypeError as e:
33     print(e) # Output: Input must be a list.
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
anumandlarithika@Mac Ai_Assisted_lab % /usr/bin/python3 /Users/anumandlarithika/SRU/Ai_Assisted_lab/lab10.3/task04.py
[4, 8, 12]
[4, 8, 12]
[6, 12, 18]
Input must be a list.
[4, 8, 12]
```

## Problem Statement 5: — AI-Assisted Performance Optimization

**Scenario:** You are given a function that processes a list of integers, but it runs slowly on large datasets:

```
def sum_of_squares(numbers):
```

```
    total = 0
```

```
    for num in numbers:
```

```
        total += num ** 2
```

```
    return total
```

Instructions:

1. Test the function with a large list (e.g., `range(1000000)`).
2. Use AI to:
  - o Analyze time complexity.
  - o Suggest performance improvements (e.g., using built-in functions, vectorization with NumPy if applicable).
  - o Provide an optimized version.
3. Compare execution time before and after optimization.
4. Discuss trade-offs between readability and performance. Expected Output: An optimized function, such as: `def sum_of_squares_optimized(numbers): return sum(x * x for x in numbers)`

### 1 ) Original Code :

```
def sum_of_squares(numbers): total = 0 for num in numbers: total += num ** 2 return total
```

### 2) Manual Testing with Large Dataset :

```
import time

numbers = range(1000000)

start = time.time()

print(sum_of_squares(numbers))

end = time.time()

print("Execution Time (Original):", end - start)
```

### 3) AI Prompt Used :

Analyze the time complexity of this function. Suggest performance improvements using Python built-in functions. Provide an optimized version and explain improvements.

```
def sum_of_squares(numbers): total = 0 for num in numbers: total += num ** 2 return total
```

### 4) AI Analysis :

#### Time Complexity

- Loop runs  $n$  times
- Each iteration constant time
- Overall Time Complexity:  **$O(n)$**

#### Space Complexity

- $O(1)$  (only one variable used)

### 5) AI Suggested Optimized Version :

```
def sum_of_squares_optimized(numbers):

    return sum(x * x for x in numbers)
```

### 6) Compare Execution Time :

```
start = time.time()

print(sum_of_squares_optimized(numbers))
```

```
end = time.time()
```

```
print("Execution Time (Optimized):", end - start)
```

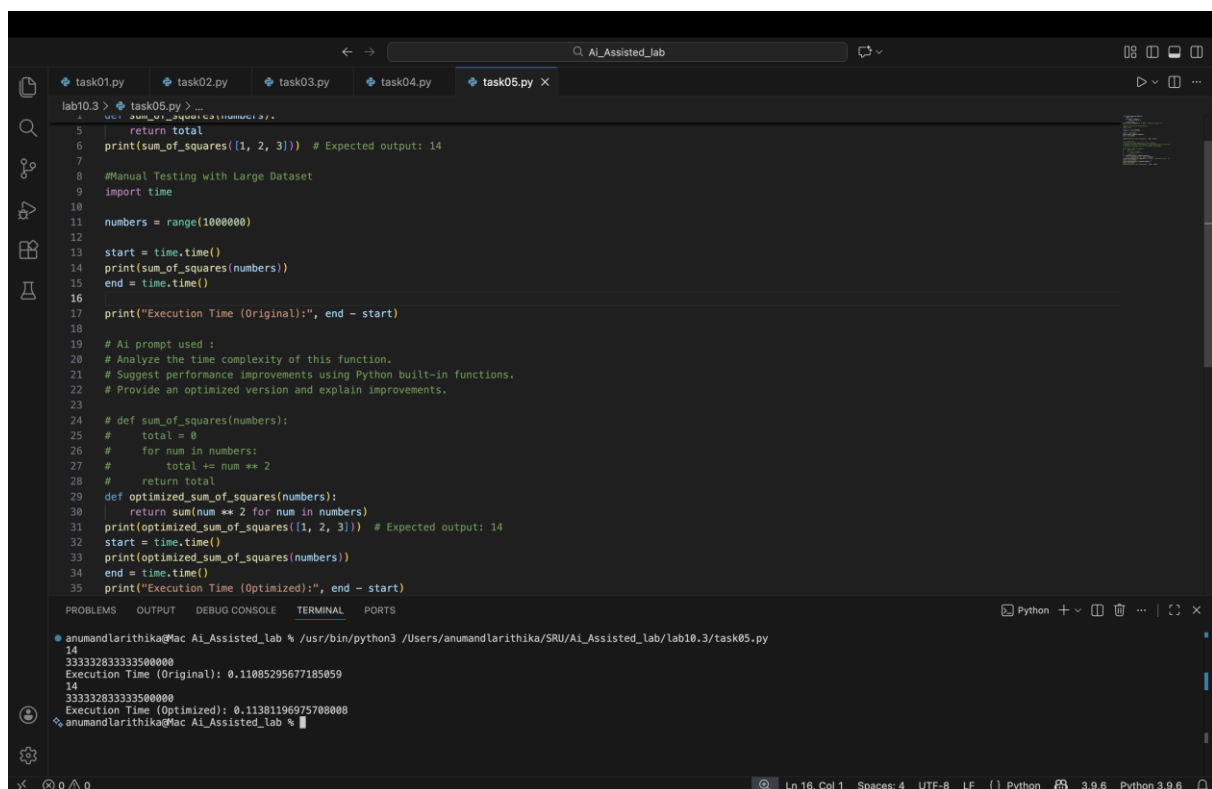
## 7) Expected Output Example :

Execution Time (Original): 0.12

Execution Time (Optimized): 0.08

## 8) explanation :

AI helped analyze algorithm complexity and suggested improvements using built-in functions and vectorization techniques. This demonstrates AI's usefulness in performance tuning while maintaining readability.



The screenshot shows a VS Code editor with a file named `task05.py` open. The script contains a function `sum_of_squares` and an `optimized_sum_of_squares` function. It includes a manual testing section with a large dataset of 1,000,000 numbers. The script prints the execution time for both functions. The terminal output shows the execution times: 0.11085295677185059 for the original function and 0.11381196975708008 for the optimized function. The status bar at the bottom indicates the file is at line 16, column 1, using UTF-8 encoding, and the Python version is 3.9.6.

```
lab10.3 > task05.py > ...
5     return total
6     print(sum_of_squares([1, 2, 3])) # Expected output: 14
7
8     #Manual Testing with Large Dataset
9     import time
10
11     numbers = range(1000000)
12
13     start = time.time()
14     print(sum_of_squares(numbers))
15     end = time.time()
16
17     print("Execution Time (Original):", end - start)
18
19     # Ai prompt used :
20     # Analyze the time complexity of this function.
21     # Suggest performance improvements using Python built-in functions.
22     # Provide an optimized version and explain improvements.
23
24     # def sum_of_squares(numbers):
25     #     total = 0
26     #     for num in numbers:
27     #         total += num ** 2
28     #     return total
29
30     def optimized_sum_of_squares(numbers):
31         return sum(num ** 2 for num in numbers)
32
33     print(optimized_sum_of_squares([1, 2, 3])) # Expected output: 14
34     start = time.time()
35     print(optimized_sum_of_squares(numbers))
36     end = time.time()
37     print("Execution Time (Optimized):", end - start)
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
anumandlarithika@Mac Ai_Assisted_lab % /usr/bin/python3 /Users/anumandlarithika/SRU/Ai_Assisted_lab/lab10.3/task05.py
14
33333283333335000000
Execution Time (Original): 0.11085295677185059
14
33333283333335000000
Execution Time (Optimized): 0.11381196975708008
%anumandlarithika@Mac Ai_Assisted_lab %
```

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