

Lab assignment - 1.4

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TASK - 0

Install and configure GitHub Copilot in VS Code. Take screenshots of each step.



Task 1: AI-Generated Logic Without Modularization (Prime Number Check Without Functions)

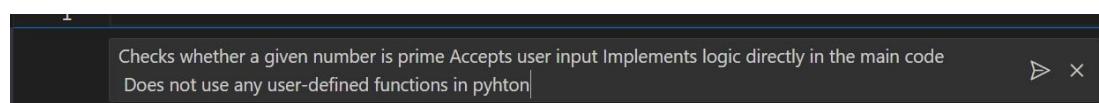
❖ Scenario

➢ You are developing a basic validation script for a numerical learning application.

❖ Task Description

Use GitHub Copilot to generate a Python program that:

- Checks whether a given number is prime
 - Accepts user input
 - Implements logic directly in the main code
 - Does not use any user-defined functions
- ❖ Expected Output
- Correct prime / non-prime result
 - Screenshots showing Copilot-generated code suggestions
 - Sample inputs and outputs



```

ass-1.4.py > ...
1 # Prime number checker without user-defined functions
2
3 number = int(input("Enter a number to check if it is prime: "))
4
5 if number < 2:
6     print(f"{number} is not a prime number.")
7 else:
8     is_prime = True
9     for i in range(2, int(number ** 0.5) + 1):
10         if number % i == 0:
11             is_prime = False
12             break
13
14     if is_prime:
15         print(f"{number} is a prime number.")
16     else:
17         print(f"{number} is not a prime number.")

```

```

:D:\AI_ASSISTANT_CODING\ass-1.4.py
Enter a number to check if it is prime: 5
5 is a prime number.
○ PS D:\AI_ASSISTANT_CODING>

```

Task 2: Efficiency & Logic Optimization (Cleanup)

❖ Scenario

The script must handle larger input values efficiently.

❖ Task Description

Review the Copilot-generated code from Task 1 and improve it by:

- Reducing unnecessary iterations
- Optimizing the loop range (e.g., early termination)
- Improving readability
- Use Copilot prompts like:
 - “Optimize prime number checking logic”
 - “Improve efficiency of this code”

Hint:

Prompt Copilot with phrases like

“optimize this code”, “simplify logic”, or “make it more readable”

❖ Expected Output

- Original and optimized code versions

- Explanation of how the improvements reduce time complexity

optimize prime number checking logic and improve efficiency of this code



Auto

Add Context...

```

18     # Prime number checker without user-defined functions
19
20     number = int(input("Enter a number to check if it is prime: "))
21
22     # Check if prime
23     is_prime = number > 1 and all(number % i != 0 for i in range(2, int(number ** 0.5) + 1))
24
25     print(f"{number} is {'a prime' if is_prime else 'not a prime'}")
26
27

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

PS D:\AI_ASSISTANT_CODING> & "C:/Users/Achandi sai teja/AppData/Local/Programs/Python/Python313/python.exe" ./AI_ASSISTANT_CODING/ass-1.4.py
5 is a prime number.
Enter a number to check if it is prime: 5
5 is a prime number.
PS D:\AI_ASSISTANT_CODING>

The optimization checks divisibility only up to \sqrt{n} instead of n , reducing unnecessary iterations. This works because any composite number must have a factor less than or equal to \sqrt{n} . Early termination using break or all() stops execution as soon as a divisor is found. Thus, time complexity improves from $O(n)$ to $O(\sqrt{n})$, with best case $O(1)$.

Task 3: Modular Design Using AI Assistance (Prime Number Check Using Functions)

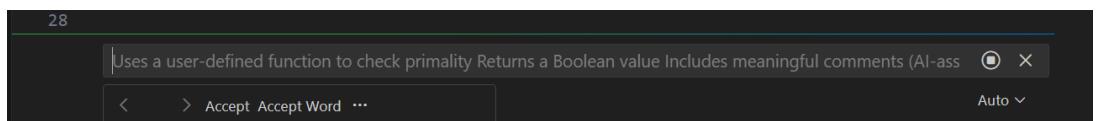
❖ Scenario

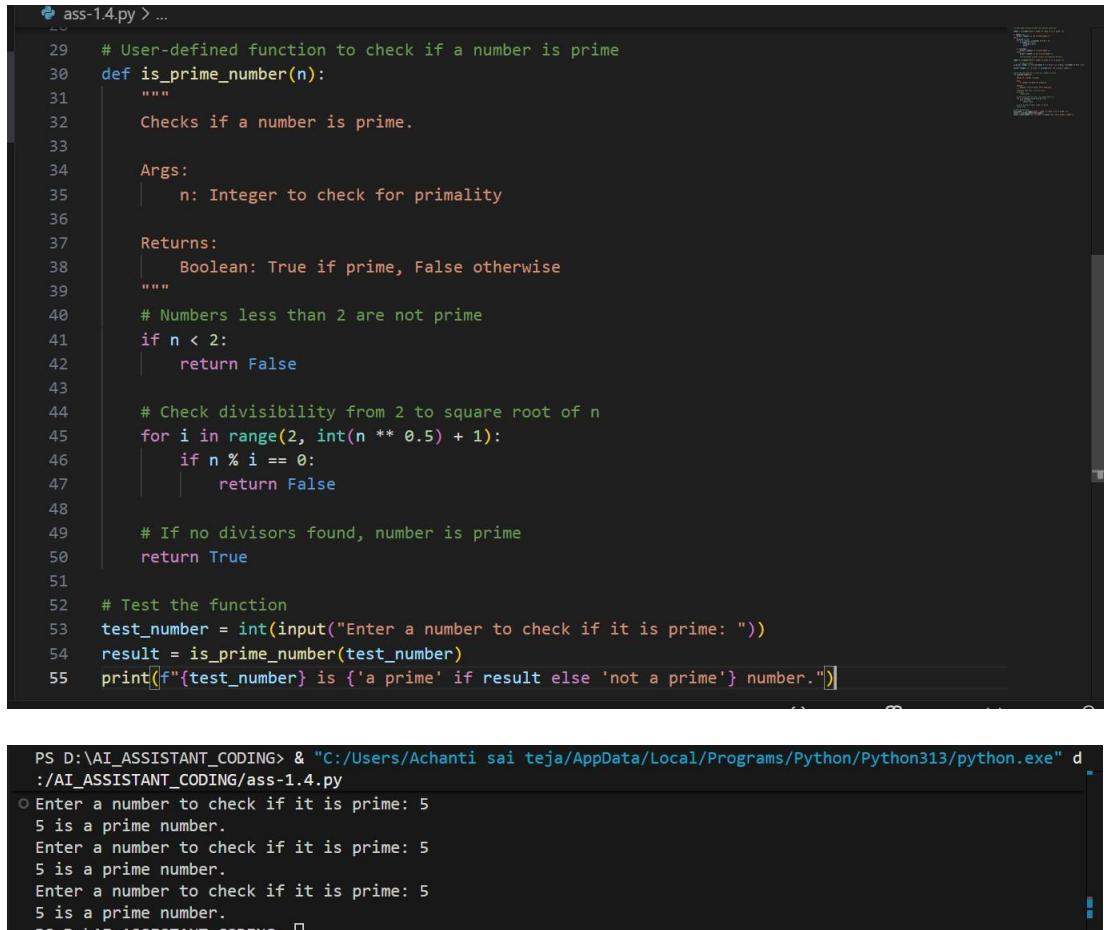
The prime-checking logic will be reused across multiple modules.

❖ Task Description

Use GitHub Copilot to generate a function-based Python program that:

- Uses a user-defined function to check primality
 - Returns a Boolean value
 - Includes meaningful comments (AI-assisted)
- ❖ Expected Output
- Correctly working prime-checking function
 - Screenshots documenting Copilot's function generation
 - Sample test cases and outputs





```

ass-1.4.py > ...
29 # User-defined function to check if a number is prime
30 def is_prime_number(n):
31     """
32     Checks if a number is prime.
33
34     Args:
35         n: Integer to check for primality
36
37     Returns:
38         Boolean: True if prime, False otherwise
39     """
40     # Numbers less than 2 are not prime
41     if n < 2:
42         return False
43
44     # Check divisibility from 2 to square root of n
45     for i in range(2, int(n ** 0.5) + 1):
46         if n % i == 0:
47             return False
48
49     # If no divisors found, number is prime
50     return True
51
52 # Test the function
53 test_number = int(input("Enter a number to check if it is prime: "))
54 result = is_prime_number(test_number)
55 print(f"{test_number} is {'a prime' if result else 'not a prime'} number.")

```

PS D:\AI_ASSISTANT_CODING> & "C:/Users/Achandi sai teja/AppData/Local/Programs/Python/Python313/python.exe" d :/AI_ASSISTANT_CODING/ass-1.4.py

- Enter a number to check if it is prime: 5
5 is a prime number.
- Enter a number to check if it is prime: 5
5 is a prime number.
- Enter a number to check if it is prime: 5
5 is a prime number.

Task 4: Comparative Analysis –With vs Without Functions

❖ Scenario

You are participating in a technical review discussion.

❖ Task Description

Compare the Copilot-generated programs:

➢ Without functions (Task 1)

➢ With functions (Task 3)

➢ Analyze them based on:

➢ Code clarity

➢ Reusability

➢ Debugging ease

➢ Suitability for large-scale applications

❖ Expected Output

Comparison table or short analytical report

Comparison Report of the 3 Prime Number Checker Codes

Code 1 – Loop with flag and break:

Uses a loop up to \sqrt{n} and stops early when a divisor is found. Efficient and easy to understand. Time complexity is $O(\sqrt{n})$.

Code 2 – all() with generator expression:

Also checks up to \sqrt{n} but uses Python's built-in `all()` with short-circuiting. More concise and Pythonic, same $O(\sqrt{n})$ time complexity, slightly better readability.

Code 3 – User-defined function (`is_prime_number`)

Encapsulates logic in a function, improving reusability and modularity. Performance is the same ($O(\sqrt{n})$), best suited for larger programs or repeated checks.

Overall Conclusion:

All three have the same time complexity ($O(vn)$). Code 2 is the most concise, Code 1 is beginner-friendly, and Code 3 is best for structured and reusable code.

Task 5: AI-Generated Iterative vs Recursive Fibonacci Approaches (Different Algorithmic Approaches to Prime Checking)

❖ Scenario

Your mentor wants to evaluate how AI handles alternative logical strategies.

❖ Task Description

Prompt GitHub Copilot to generate:

- A basic divisibility check approach
- An optimized approach (e.g., checking up to \sqrt{n})

❖ Expected Output

- Two correct implementations

➢ Comparison discussing:

- Execution flow
- Time complexity
- Performance for large inputs
- When each approach is appropriate

A basic divisibility check approach

```
# Basic divisibility check approach
def basic_divisibility_check(n):
    if n < 2:
        return False
    for i in range(2, n):
        if n % i == 0:
            return False
    return True

# Test the basic divisibility check
test_number = int(input("Enter a number to check if it is prime using basic divisibility: "))
result = basic_divisibility_check(test_number)
print(f"{test_number} is {'a prime' if result else 'not a prime'} number.")
```

```
Enter a number to check if it is prime using basic divisibility: 3
3 is a prime number.
```

```
D:\AI_ASSISTANT_CODING>
```

An optimized approach

Add Context...

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```
71     print(f"Factorial of {number} is {result}")
```

The screenshot shows the Visual Studio Code interface with the Extensions Marketplace open. A search bar at the top has 'github copilot' typed into it. Below the search bar, several extensions are listed:

- GitHub Copilot**: Your AI pair programmer by GitHub. Status: 3416ms.
- GitHub Copilot Chat**: AI chat features powered by Copilot by GitHub. Status: 3416ms.
- GitHub Copilot for ...**: GitHub Copilot for Azure is the @az... by Microsoft. Status: 938K ⭐ 3.5. Includes an 'Install' button.
- GitHub Copilot app ...**: Upgrade and migrate your applicati... by Microsoft. Status: 592K ⭐ 2. Includes an 'Install' button.
- GitHub Copilot app ...**: Upgrade Java project with GitHub C... by Microsoft. Status: 572K ⭐ 2. Includes an 'Install' button.
- BLACKBOXAI #1 AI ...**: BLACKBOX AI is an AI coding assist... by BLACKBOXAI. Status: 4.6M ⭐ 4. Includes an 'Install' button.
- Copilot Theme**: A VSCode implementation of the th... by Benjamin Benais. Status: 550K ⭐ 5. Includes an 'Install' button.

The main code editor window displays a Python script named 'ass-1.4.py' with the following code:

```
def is_prime_optimized(n):  
    """  
    Optimized prime checker using 6k±1 method.  
    All primes > 3 are of the form 6k±1.  
    """  
    if n <= 1:  
        return False  
    if n <= 3:  
        return True  
    if n % 2 == 0 or n % 3 == 0:  
        return False  
  
    i = 5  
    while i * i <= n:  
        if n % i == 0 or n % (i + 2) == 0:  
            return False  
        i += 6  
    return True  
  
# Test the optimized function  
test_number = int(input("Enter a number to check if it is prime using optimized approach: "))  
result = is_prime_optimized(test_number)  
print(f"{test_number} is {'a prime' if result else 'not a prime'} number.")
```

The terminal below shows the output of running the script:

```
PS D:\AI_ASSISTANT_CODING> 3 is a prime number.
```

```
Enter a number to check if it is prime using basic divisibility: 3
```

```
3 is a prime number.
```

```
PS D:\AI_ASSISTANT_CODING>
```

Comparison (Short Notes)

Execution Flow:

Basic divisibility: Checks all numbers from 2 to $n-1$ sequentially.

Optimized (\sqrt{n}): Checks divisors only up to \sqrt{n} and stops early if a factor is found.

Function-based: Same optimized flow but wrapped in a reusable function.

Time Complexity:

Basic divisibility: $O(n)$

Optimized (\sqrt{n}): $O(\sqrt{n})$

Function-based optimized: $O(\sqrt{n})$

Performance for Large Inputs:

Basic approach is slow and inefficient for large numbers.

Optimized approaches are much faster and suitable for large inputs.

Function-based version performs the same but is cleaner for repeated use.

When Each Approach Is Appropriate

Basic approach: For learning and very small inputs.

Optimized approach: For efficient single checks.

Function-based approach: For structured programs and multiple prime checks.