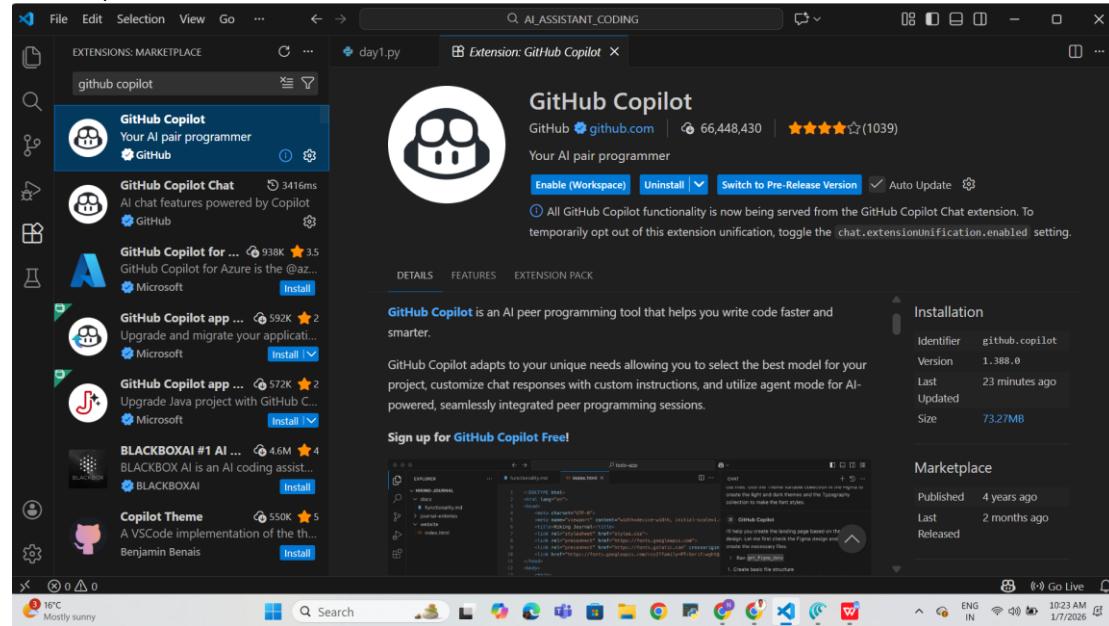


## TASK - 0

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

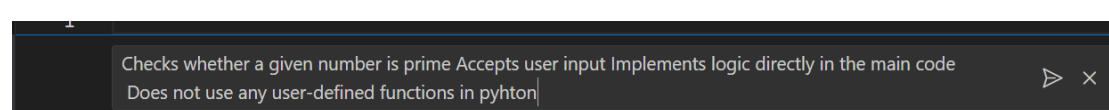
❖ Scenario

➢ 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.")

```

```

./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



Add Context...

Auto ▾

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

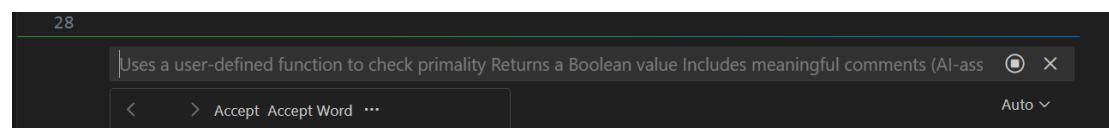
#### ❖ Task Description

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

- Uses a user-defined function to check primality
  - Returns a Boolean value

➤ Includes meaning

- ❖ 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/Achanti 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.
PS D:\AI_ASSISTANT_CODING>
```

#### 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 ( $O(\sqrt{n})$ ). 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.
```

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

An optimized approach

∅ Add Context...

▷ X

Auto ▾

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

The screenshot shows the Visual Studio Code interface. The left sidebar displays the 'EXTENSIONS: MARKETPLACE' section with the search term 'github copilot'. The 'GitHub Copilot' extension by GitHub is listed at the top, followed by other extensions like 'GitHub Copilot Chat', 'GitHub Copilot for Azure', 'GitHub Copilot app...', 'GitHub Copilot app...', 'BLACKBOXAI #1 AI...', and 'Copilot Theme'. The main editor area contains a Python script named 'ass-14.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 with the input '3':

```
Enter a number to check if it is prime using optimized approach: 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.