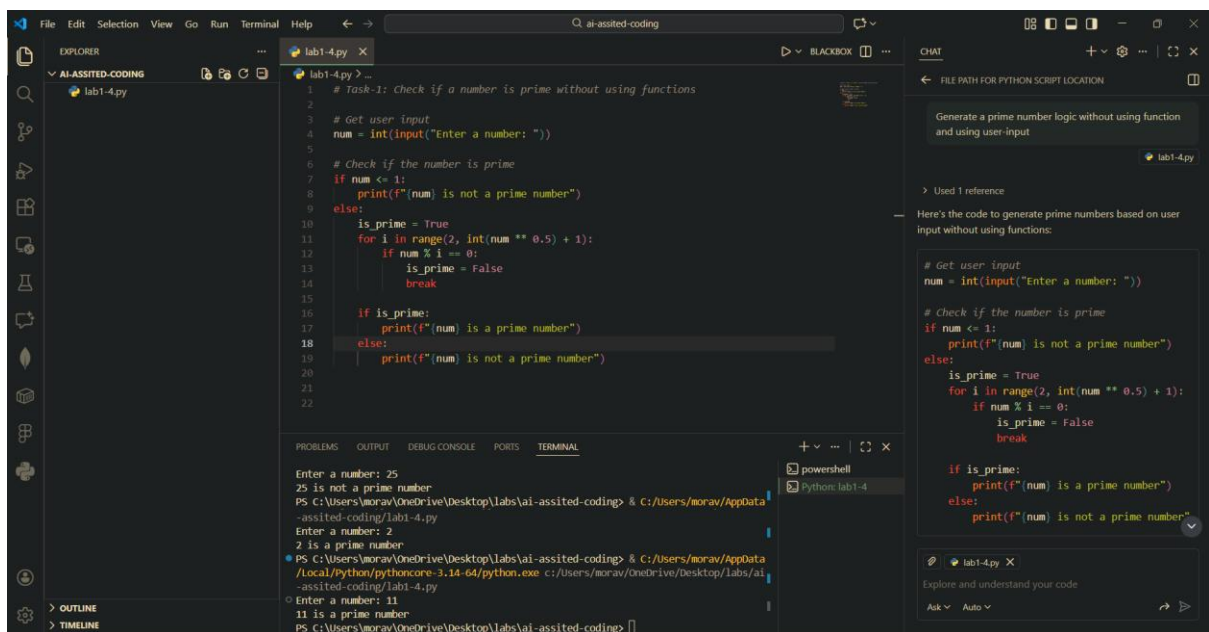


NAME : VANGA MANIKANTA VARAPRASAD

ROLL NO: 2303A52130

BATCH: 44

## Task-1



```
1 # Task-1: Check if a number is prime without using functions
2
3 # Get user input
4 num = int(input("Enter a number: "))
5
6 # Check if the number is prime
7 if num <= 1:
8     print(f"{num} is not a prime number")
9 else:
10     is_prime = True
11     for i in range(2, int(num ** 0.5) + 1):
12         if num % i == 0:
13             is_prime = False
14             break
15
16     if is_prime:
17         print(f"{num} is a prime number")
18     else:
19         print(f"{num} is not a prime number")
20
21
22
```

Enter a number: 25  
25 is not a prime number  
PS C:\Users\morav\OneDrive\Desktop\labs\ai-assited-coding> & C:/Users/morav/AppData  
-assited-coding/lab1-4.py  
Enter a number: 2  
2 is a prime number  
PS C:\Users\morav\OneDrive\Desktop\labs\ai-assited-coding> & C:/Users/morav/AppData  
/local/python/pythoncore-3.14-64/python.exe c:/Users/morav/OneDrive/Desktop/labs/ai  
-assited-coding/lab1-4.py  
Enter a number: 11  
11 is a prime number  
PS C:\Users\morav\OneDrive\Desktop\labs\ai-assited-coding>

PROMPTS:

Generate a prime number logic without using function and using user-input

Input: 5

Output: 5 is a prime number

Input:25

Output: 25 is mot a prime number

## Task-2

```
lab1-4.py > ...
1 # Task-1: Check if a number is prime without using functions
2
3 # Get user input
4 num = int(input("Enter a number: "))
5
6 # Check if the number is prime
7 if num <= 1:
8     print(f"{num} is not a prime number")
9 elif num == 2:
10    print(f"{num} is a prime number")
11 elif num % 2 == 0:
12    print(f"{num} is not a prime number")
13 else:
14     is_prime = True
15     # Check only odd divisors starting from 3
16     for i in range(3, int(num ** 0.5) + 1, 2):
17         if num % i == 0:
18             is_prime = False
19             break
20
21 if is_prime:
22     print(f"{num} is a prime number")
23 else:
24     print(f"{num} is not a prime number")
25
```

PROBLEMS OUTPUT DEBUG CONSOLE PORTS TERMINAL

terminal: a number: 25  
25 is not a prime number  
PS C:\Users\morav\OneDrive\Desktop\labs\ai-assisted-coding> & C:/Users/morav/AppData/Local/Python/pythoncore-3.14-64/python.exe c:/Users/morav/OneDrive/Desktop/labs/ai-assisted-coding/lab1-4.py  
Enter a number: 2  
2 is a prime number  
PS C:\Users\morav\OneDrive\Desktop\labs\ai-assisted-coding> & C:/Users/morav/AppData/Local/Python/pythoncore-3.14-64/python.exe c:/Users/morav/OneDrive/Desktop/labs/ai-assisted-coding/lab1-4.py  
Enter a number: 11  
11 is a prime number  
PS C:\Users\morav\OneDrive\Desktop\labs\ai-assisted-coding> |

CHAT

FILE PATH FOR PYTHON SCRIPT LOCATION

Optimize prime number checking logic

lab1-4.py

> Used 1 reference

Here's the optimized prime number checking logic:

```
# Task-1: Check if a number is prime without
# Get user input
num = int(input("Enter a number: "))

# Check if the number is prime
if num <= 1:
    print(f"{num} is not a prime number")
elif num == 2:
    print(f"{num} is a prime number")
elif num % 2 == 0:
    print(f"{num} is not a prime number")
else:
    is_prime = True
    # Check only odd divisors starting from
    for i in range(3, int(num ** 0.5) + 1, 2):
        if num % i == 0:
            is_prime = False
            break

    if is_prime:
```

lab1-4.py X

Explore and understand your code

Ask Auto

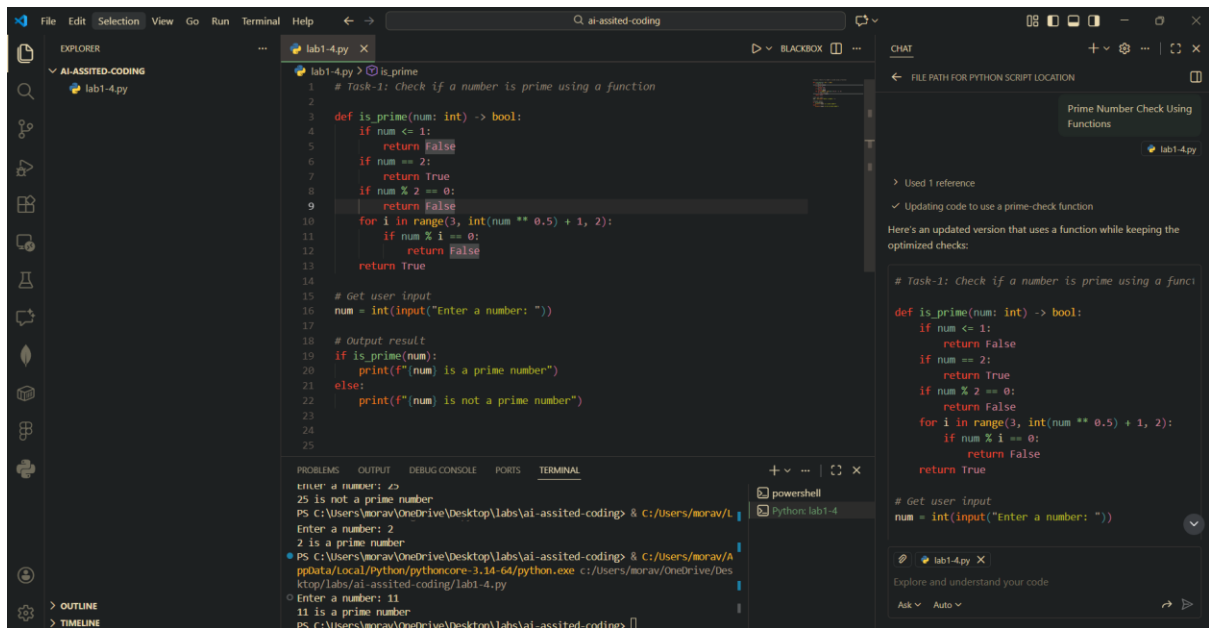
PROMPT:

Optimize prime number checking logic

Original code runs the loop to n times on checking the condition one by one

Since Optimized code runs skipping the odd divisors reducing the number of loops

## Task-3



PROMPT:

Prime Number Check Using Functions

**Code:**

```
def is_prime(num: int) -> bool:
```

```
    if num <= 1:
```

```
        return False
```

```
    if num == 2:
```

```
        return True
```

```
    if num % 2 == 0:
```

```
        return False
```

```
    for i in range(3, int(num ** 0.5) + 1, 2):
```

```
        if num % i == 0:
```

```
            return False
```

```
    return True
```

**Test Cases:**

Input: 5

Output: 5 is a prime number

Input: 2

Output: 2 is a prime number

Input: 15

Output: 15 is not a prime number

Task-4

CHAT

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← FILE PATH FOR PYTHON SCRIPT LOCATION 📁

Comparative Analysis –With vs Without Functions  
Expected Output  
Comparison table or short analytical report

📄 lab1-4.py

> Used 1 reference

✓ Preparing comparison summary

Here's a concise comparison of prime checking with vs. without a function:

Aspect	With Function ( <code>is_prime</code> )	Without Function (inline)
Reusability	High: callable from anywhere	Low: logic duplicated where needed
Readability	Clear, self-documenting	Mixed: logic embedded in flow
Testability	Easy to unit test function	Harder: must wrap logic for tests
Maintainability	Single place to update logic	Multiple updates if repeated
Modularity	Encapsulated responsibility	Tightly coupled to I/O flow
I/O Separation	Possible to separate pure logic from input/output	Often intertwined with input/output
Extensibility	Simple to extend (e.g., memoization, caching)	Changes require inlining everywhere
Code Size (per use)	Slight overhead for definition, small calls	Shorter once, longer when reused

Comparison Table:

Aspect	With Function ( <code>is_prime</code> )	Without Function (inline)
Reusability	High: callable from anywhere	Low: logic duplicated where needed

Aspect	With Function ( <a href="#">is_prime</a> )	Without Function (inline)
Readability	Clear, self-documenting	Mixed: logic embedded in flow
Testability	Easy to unit test function	Harder: must wrap logic for tests
Maintainability	Single place to update logic	Multiple updates if repeated
Modularity	Encapsulated responsibility	Tightly coupled to I/O flow
I/O Separation	Possible to separate pure logic from input/output	Often intertwined with input/output
Extensibility	Simple to extend (e.g., memoization, caching)	Changes require inlining everywhere
Code Size (per use)	Slight overhead for definition, small calls	Shorter once, longer when reused

TASK-5

lab1-4.py

```
def is_prime(num: int) -> bool:
    if num <= 1:
        return False
    if num == 2:
        return True
    # Single user input reused for both approaches
    num = int(input("Enter a number: "))
    # Function-based check
    if is_prime(num):
        print(f"[with function] {num} is a prime number")
    else:
        print(f"[with function] {num} is not a prime number")
    # Inline (no-function) check
    if num <= 1:
        inline_prime = False
    elif num == 2:
        inline_prime = True
    elif num % 2 == 0:
        inline_prime = False
    else:
        inline_prime = True
        for i in range(3, int(num ** 0.5) + 1, 2):
            if num % i == 0:
                inline_prime = False
                break
    if inline_prime:
        print(f"[without function] {num} is a prime number")
    else:
        print(f"[without function] {num} is not a prime number")
```

Aspect	Iterative	Recursive (naïve)
Time complexity	$O(n)$	$O(n^n)$ without memoization
Space	$O(1)$	$O(n)$ call stack
Speed	Fast	Very slow for larger $n$
Stack safety	Safe	Risk of recursion depth errors
Clarity	Clear loop	Simple definition, but inefficient

Approach	Complexity	Best for	Notes
Trial division up to $n$	$O(n)$	Very small $n$	Slow; checks all divisors
Trial division up to $\sqrt{n}$	$O(\sqrt{n})$	Small/medium $n$	Common baseline
Skip evens / $6k \pm 1$	$\sim \frac{1}{2} - \frac{1}{3}$ of $\sqrt{n}$ checks	Small/medium $n$	Prunes obvious composites
Deterministic Miller-Rabin (32/64-bit)	$\sim O(k \log^3 n)$	Larger ints, single check	Fast and exact with fixed bases
Probabilistic Miller-Rabin	$\sim O(k \log^3 n)$	Very large ints	Tiny error probability; tune $k$
Sieve of Eratosthenes	$O(n \log \log n)$ preprocess; $O(1)$ query	Many queries up to a limit	Extra memory; great for batches
Segmented sieve	$O(n \log \log n)$	Many queries in ranges	Memory-friendly for large ranges

EXECUTION FLOW

WITH FUNCTION:

- Main flow  $\rightarrow$  `is_prime()` call  $\rightarrow$  returns boolean

- Function scope isolated from main logic
- Single code path, reusable across program

| WITHOUT FUNCTION:

- Inline logic directly in main flow
- All conditions evaluated in-place
- Must repeat code if used multiple times

└ TIME COMPLEXITY :

| Both approaches:  $O(\sqrt{n})$

- Check divisors from 2 to  $\sqrt{n}$
- Skip even numbers (optimization)
- Early exit on first divisor found

| Operations count (approx):

- $n = 100$ : ~5 iterations worst case
- $n = 1,000$ : ~16 iterations
- $n = 1,000,000$ : ~500 iterations

## └ PERFORMANCE FOR LARGE INPUTS

| WITH FUNCTION:

- | ✓ Identical algorithm performance |
- | + Function call overhead: ~1-2 microseconds |
- | + Negligible for single calls |
- | + Better for multiple calls (code reuse) |

| WITHOUT FUNCTION:

- | ✓ Slightly faster (no function call overhead) |
- | - Marginal difference: <1% faster |

- Code duplication increases file size
- Harder to optimize if needed later

┐ WHEN EACH APPROACH IS APPROPRIATE \_\_\_\_\_

### | USE FUNCTION-BASED WHEN:

- | ✓ Checking primality multiple times in code
- | ✓ Building larger programs/libraries
- | ✓ Need unit testing capability
- | ✓ Want clean, maintainable code
- | ✓ Extending logic later (e.g., caching)
- | ✓ Working in teams (better code organization)

| USE INLINE (NO FUNCTION) WHEN:

- | ✓ One-time check in simple script |
- | ✓ Performance-critical (negligible difference) |
- | ✓ Learning/prototyping phase |
- | ✓ Ultra-minimal code footprint required |
- | ⚠ Generally NOT recommended for production |