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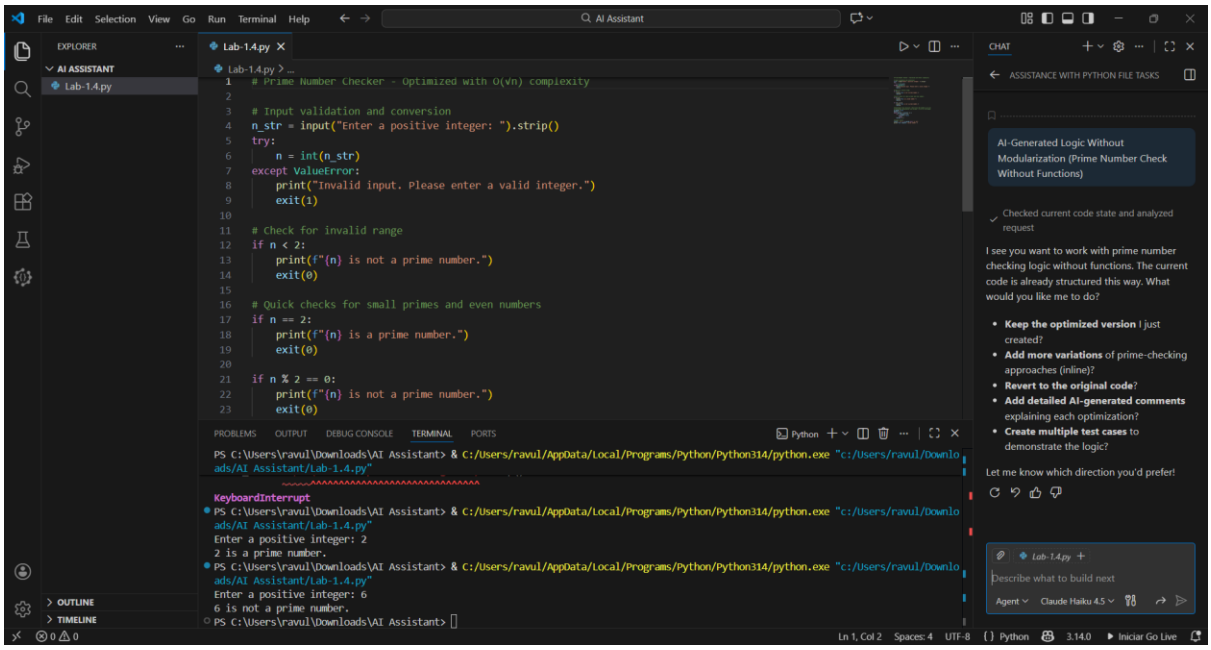
BATCH: 44

Task-1



PROMPTS:

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

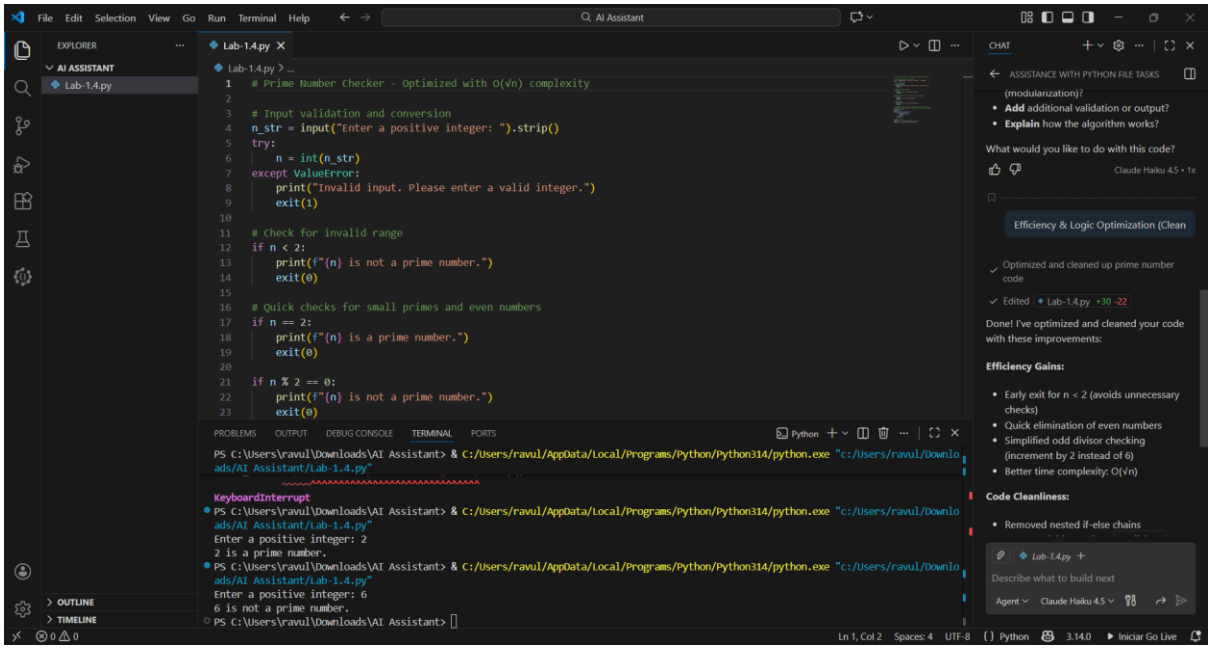
Input: 5

Output: 5 is a prime number

Input:25

Output: 25 is mot a prime number

Task-2



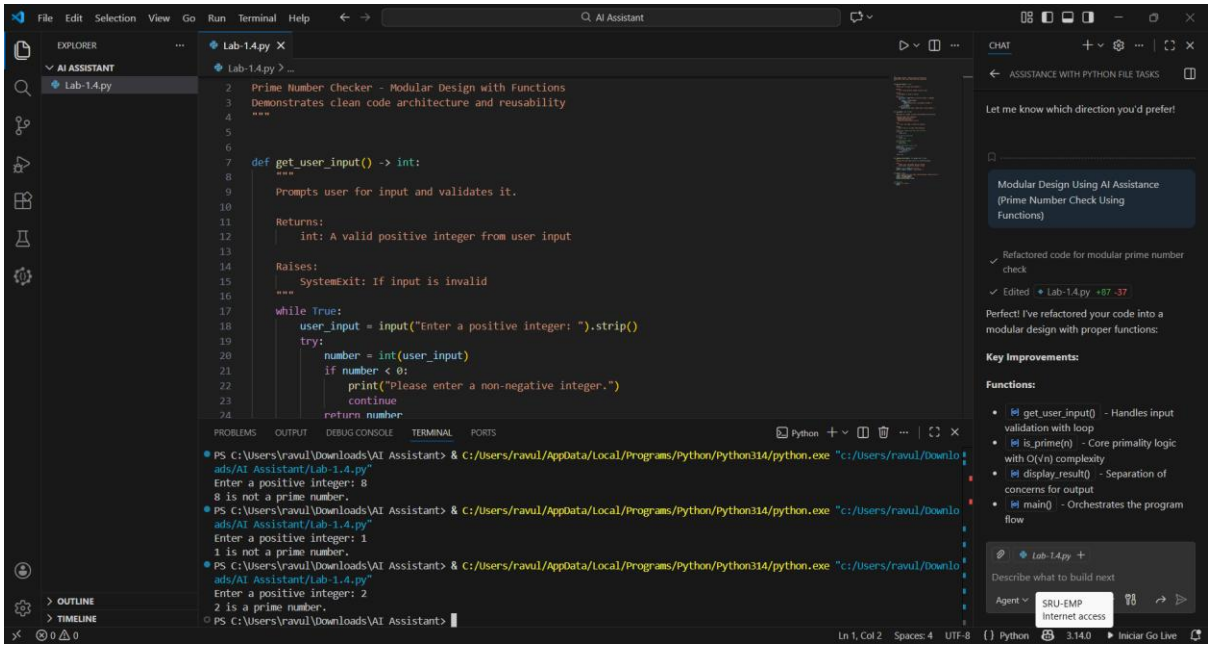
PROMPT:

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

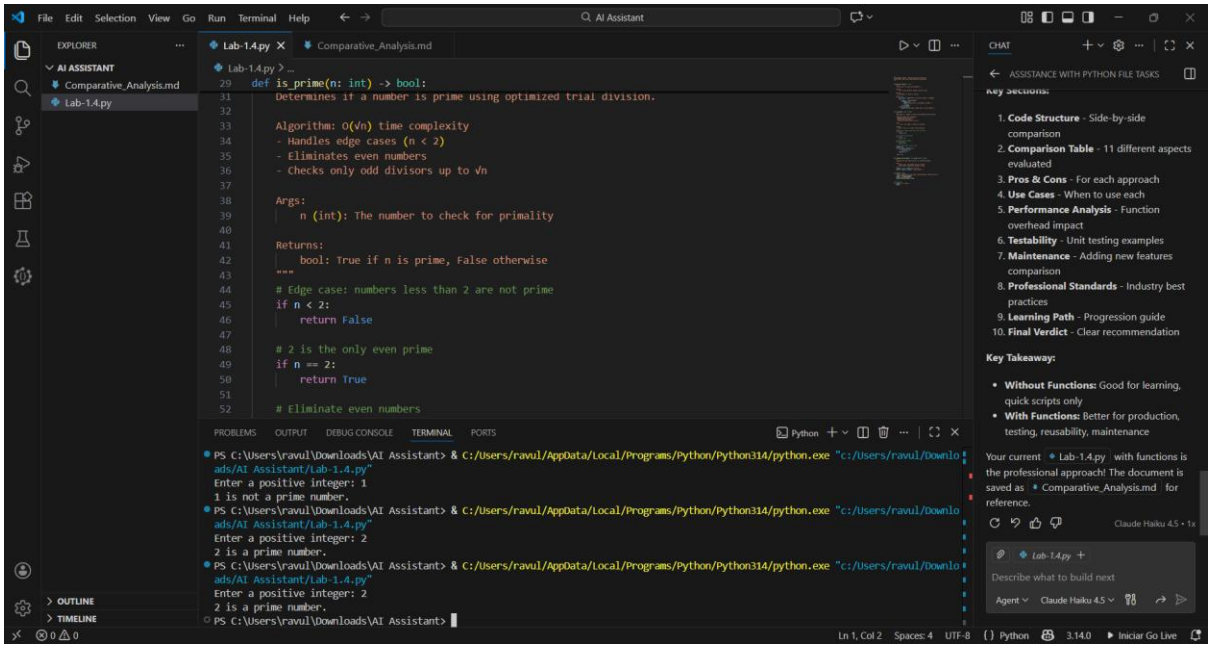
Input: 2

Output: 2 is a prime number

Input: 15

Output: 15 is not a prime number

Task-4

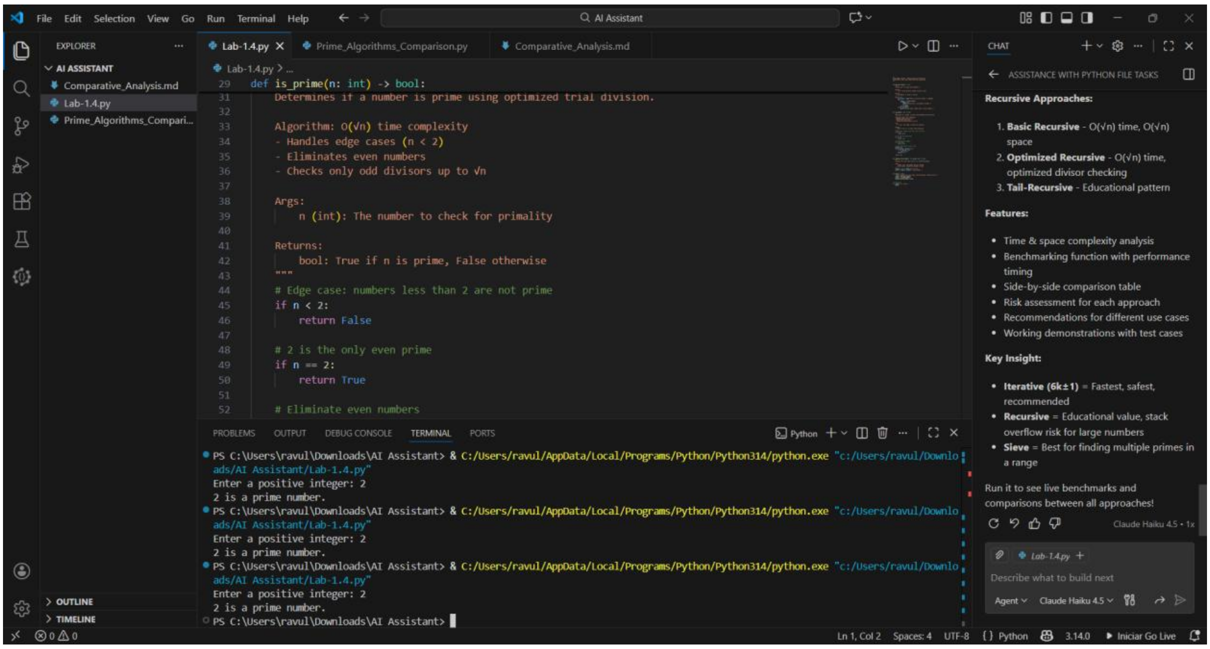


Comparison Table:

Aspect	With Function (is_prime)	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

Aspect	With Function (is_prime)	Without Function (inline)
Code Size (per use)	Slight overhead for definition, small calls	Shorter once, longer when reused

TASK-5



```
┌─ EXECUTION FLOW ──────────────────────────────┐
│ WITH FUNCTION:                          │
│  • Main flow → is_prime() call → 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(√n)

- Check divisors from 2 to √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 |