

Lab Exercise 2- Code Refactoring & Analysis Using GitHub Copilot in VS Code

Objective

- Analyze existing code with GitHub Copilot.
- Improve efficiency, readability, and structure.
- Use Copilot's suggestions to refactor code step by step.

Step 1: Open a Python File with Inefficient Code

1. Open VS Code and create a new file: complex_refactor.py.
2. Copy and paste the following inefficient Python script:

```
import time

# Function to check if a number is prime
def is_prime(n):
    if n < 2:
        return False
    for i in range(2, n):
        if n % i == 0:
            return False
    return True

# Function to find prime numbers in a range
def find_primes(start, end):
    primes = []
```

```
for num in range(start, end):
    if is_prime(num):
        primes.append(num)
return primes

# Measure execution time
start_time = time.time()
primes_list = find_primes(1, 50000)
end_time = time.time()

print(f"Primes Found: {len(primes_list)}")
print(f"Execution Time: {end_time - start_time} seconds")
```

Step 2: Use GitHub Copilot to Analyze the Code

1. Select the `is_prime()` function and press Ctrl + I (if using Copilot Chat).
2. Ask Copilot: **How can I improve this function?**
3. Copilot will suggest:
 - Optimizing prime checking using `sqrt(n)`.
 - Using a more efficient algorithm like the **Sieve of Eratosthenes**.

Step 3: Apply Copilot's Suggestions for Optimization

Modify `is_prime()` to improve performance:

```
from math import sqrt

def is_prime(n):
    """Check if a number is prime using sqrt(n) optimization."""
    if n < 2:
        return False
    if n in (2, 3):
        return True
    if n % 2 == 0 or n % 3 == 0:
        return False
    for i in range(5, int(sqrt(n)) + 1, 2):
        if n % i == 0:
            return False
    return True
```

Step 4: Use Copilot to Replace find_primes() with a Faster Algorithm

1. Select find_primes() and type a comment above it:
Improve this function for better performance using the Sieve of Eratosthenes
2. Press Tab to accept Copilot's suggestion.

Step 5: Optimized Code Using Sieve of Eratosthenes

```
import time

def sieve_of_eratosthenes(limit):
    """Finds all prime numbers up to a given limit using the Sieve of Eratosthenes."""
    primes = [True] * (limit + 1)
    primes[0], primes[1] = False, False
```

```
for i in range(2, int(limit**0.5) + 1):
    if primes[i]:
        for multiple in range(i * i, limit + 1, i):
            primes[multiple] = False
return [num for num, is_prime in enumerate(primes) if is_prime]

# Measure execution time
start_time = time.time()
primes_list = sieve_of_eratosthenes(50000)
end_time = time.time()

print(f"Primes Found: {len(primes_list)}")
print(f"Execution Time: {end_time - start_time:.6f} seconds")
```

Step 6: Validate Performance Improvement

1. Run the original and optimized scripts.
2. Compare execution times.
3. The optimized version should be significantly faster.

Lab Summary

1. Used GitHub Copilot to analyze and suggest improvements.
2. Optimized `is_prime()` using `sqrt(n)`.
3. Replaced `find_primes()` with the **Sieve of Eratosthenes**.
4. Validated performance improvement by measuring execution time.