Code Review and Quality: Using AI to Improve Code Quality and Readability

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Lab-10.3

Problem Statement 1: AI-Assisted Bug Detection

Given Code

```
def factorial(n):
    result = 1
    for i in range(1, n):
        result = result * i
    return result
```

Testing

```
print(factorial(5))
```

Output:

```
24
```

Issue Identified

The function contains an **off-by-one error**.
The loop range(1, n) stops at n-1, so it does not multiply by n.

Corrected Code

```
def factorial(n):
    if n < 0:
        raise ValueError("Factorial is not defined for negative numbers")
    if n == 0:
        return 1

    result = 1
    for i in range(1, n + 1):
        result *= i
    return result
```

Correct Output:

```
120
```

Comparison

Manual Fix	**AI Fix**
Fixed range to n+1	Fixed range and added validation
No edge case handling	Handles negative & zero cases

AI improved robustness by handling edge cases.

Problem Statement 2: Improving Readability & Documentation

Original Code

```
def calc(a, b, c):
     if c == "add":
       return a + b
   elif c == "sub":
       return a - b
   elif c == "mul":
       return a * b
   elif c == "div":
       return a / b
```

Issues

- Poor function name (calc)
- No documentation
- No exception handling
- No input validation

Improved Code

```
def calculate(number1, number2, operation):
    if not isinstance(operation, str):
        raise TypeError("Operation must be a string")

    if operation == "add":
        return number1 + number2
    elif operation == "sub":
        return number1 - number2
    elif operation == "mul":
        return number1 * number2
    elif operation == "div":
        if number2 == 0:
            raise ZeroDivisionError("Cannot divide by zero")
        return number1 / number2
    else:
        raise ValueError("Invalid operation")
```

Problem Statement 3: Enforcing PEP8 Standards

Original Code

```
def Checkprime(n):
    for i in range(2, n):
        if n % i == 0:
            return False
    return True
```

PEP8 Violations

- Function name not in snake_case
- No input validation
- No docstring

Refactored Code

```
def check_prime(n):



    if n <= 1:
        return False

    for i in range(2, n):
        if n % i == 0:
            return False
    return True
```

Problem Statement 4: AI as a Code Reviewer

Original Code

```
def processData(d):
    return [x * 2 for x in d if x % 2 == 0]
```

Issues

- Poor naming
- No validation
- No type hints
- No documentation

Improved Code

```
from typing import List, Union


def double_even_numbers(numbers: List[Union[int, float]]) -> List[Union[int, float]]:



    if not isinstance(numbers, list):
        raise TypeError("Input must be a list")

    return [
        num * 2
        for num in numbers
        if isinstance(num, (int, float)) and num % 2 == 0
    ]
```

Reflection

AI should act as an **assistant**, not a replacement for human reviewers.
It speeds up reviews but human judgment is still essential.

Problem Statement 5: AI-Assisted Performance Optimization

Original Code

```
def sum_of_squares(numbers):
    total = 0
    for num in numbers:
        total += num ** 2
    return total
```

Time Complexity

O(n)

Optimized Code

```
def sum_of_squares_optimized(numbers):
    return sum(x * x for x in numbers)
```

Comparison

Original	**Optimized**
Uses manual loop	Uses generator expression
Slightly longer	More concise
Same time complexity	Cleaner implementation

Trade-off Discussion

- Optimized version improves readability.
- For very large datasets, NumPy can provide further speed improvements.
- Built-in functions are generally faster and more Pythonic.