

# 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

Fixed range to n+1

No edge case handling

AI improved robustness by handling edge cases.

#### AI Fix

Fixed range and added validation

Handles negative & zero 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.

