

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.