Assignment – 5.5

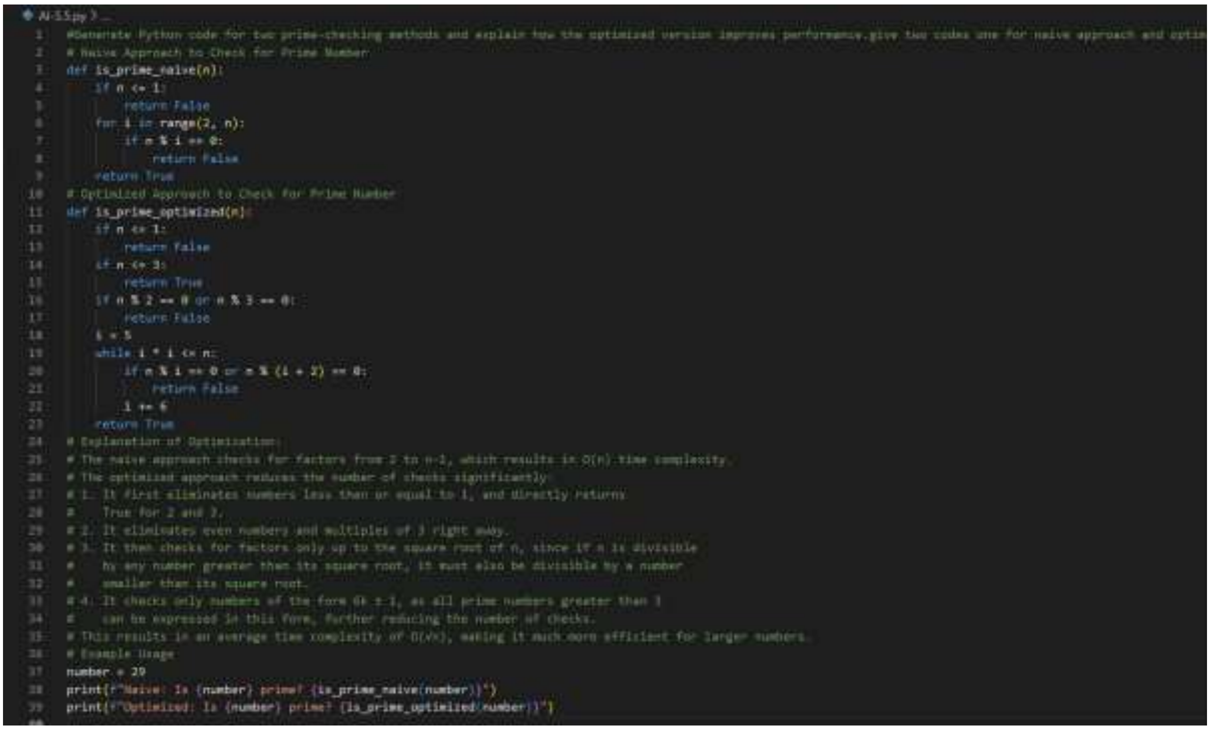
2303A51176

Task 1: Transparency in Algorithm Optimization

PROMPT :

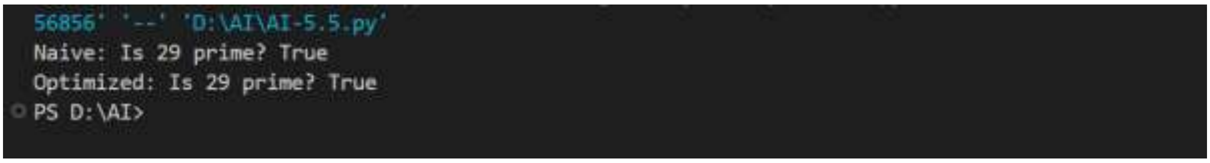
Generate Python code for two prime-checking methods and explain how the optimized version improves performance.give two codes one for naive approach and optimized approach

CODE and OUTPUT :



AI-5.5.py > ...

```python
#Generate Python code for two prime-checking methods and explain how the optimized version improves performance.give two codes one for naive approach and optim
# Naive Approach to Check for Prime Number
def is_prime_naive(n):
    if n <= 1:
        return False
    for i in range(2, n):
        if n % i == 0:
            return False
    return True
# Optimized Approach to Check for Prime Number
def is_prime_optimized(n):
    if n <= 1:
        return False
    if n <= 3:
        return True
    if n % 2 == 0 or n % 3 == 0:
        return False
    i = 5
    while i * i <= n:
        if n % i == 0 or n % (i + 2) == 0:
            return False
        i += 6
    return True
# Explanation of Optimization:
# The naive approach checks for factors from 2 to n-1, which results in O(n) time complexity.
# The optimized approach reduces the number of checks significantly:
# 1. It first eliminates numbers less than or equal to 1, and directly returns
#    True for 2 and 3.
# 2. It eliminates even numbers and multiples of 3 right away.
# 3. It then checks for factors only up to the square root of n, since if n is divisible
#    by any number greater than its square root, it must also be divisible by a number
#    smaller than its square root.
# 4. It checks only numbers of the form 6k ± 1, as all prime numbers greater than 3
#    can be expressed in this form, further reducing the number of checks.
# This results in an average time complexity of O(√n), making it much more efficient for larger numbers.
# Example Usage
number = 29
print(f"Naive: Is {number} prime? {is_prime_naive(number)}")
print(f"Optimized: Is {number} prime? {is_prime_optimized(number)}")
```



```
56856' '--' 'D:\AI\AI-5.5.py'
Naive: Is 29 prime? True
Optimized: Is 29 prime? True
PS D:\AI>
```

Justification :

We used two methods to check prime numbers to understand algorithm transparency and optimization.

- The naive approach checks all numbers from 2 to n-1, which works but is slow for large numbers.
- The optimized approach checks only up to the square root of the number, which reduces unnecessary calculations.

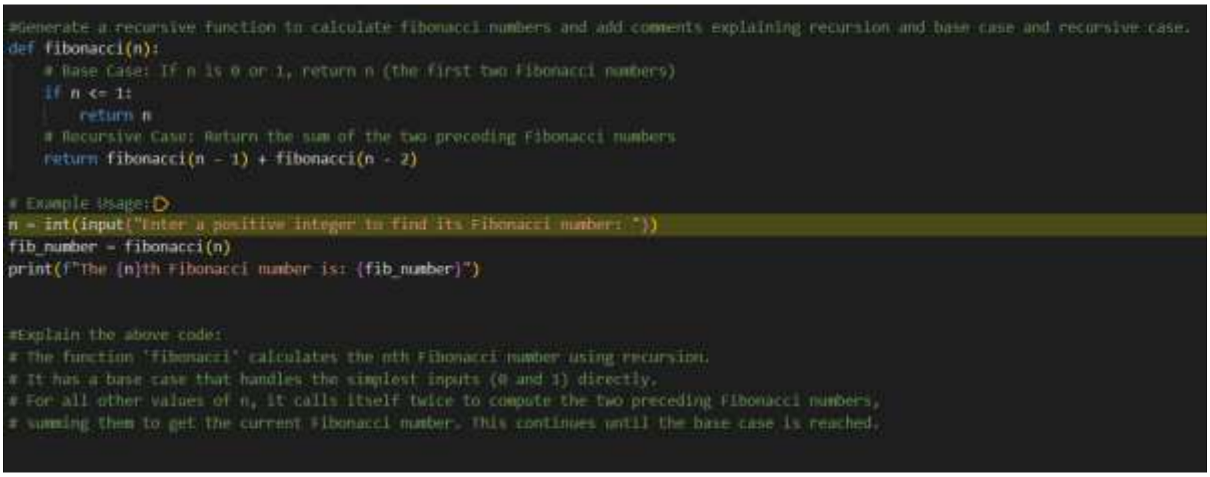
This shows how AI-generated code should be understood and improved, not blindly used. Optimized algorithms save time and computing resources, which is an ethical responsibility of **developers.**

Task 2: Transparency in Recursive Algorithms

PROMPT :

Generate a recursive function to calculate fibonacci numbers and add comments explaining recursion and base case and recursive case.

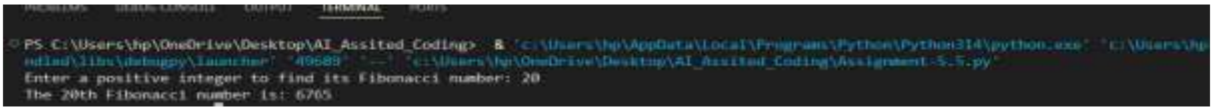
CODE and OUTPUT :



```python
#Generate a recursive function to calculate fibonacci numbers and add comments explaining recursion and base case and recursive case.
def fibonacci(n):
    # Base Case: If n is 0 or 1, return n (the first two Fibonacci numbers)
    if n <= 1:
        return n
    # Recursive Case: Return the sum of the two preceding Fibonacci numbers
    return fibonacci(n - 1) + fibonacci(n - 2)

# Example Usage:
n = int(input("Enter a positive integer to find its Fibonacci number: "))
fib_number = fibonacci(n)
print(f"The {n}th Fibonacci number is: {fib_number}")


#Explain the above code:
# The function 'fibonacci' calculates the nth Fibonacci number using recursion.
# It has a base case that handles the simplest inputs (0 and 1) directly.
# For all other values of n, it calls itself twice to compute the two preceding Fibonacci numbers,
# summing them to get the current Fibonacci number. This continues until the base case is reached.
```



```
PS C:\Users\hp\OneDrive\Desktop\AI_Assited_Coding>  & 'c:\Users\hp\AppData\Local\Programs\Python\Python314\python.exe' 'c:\Users\hp
ndled\libs\debugpy\launcher' '49689' '--' 'c:\Users\hp\OneDrive\Desktop\AI_Assited_Coding\Assignment-5.5.py'
Enter a positive integer to find its Fibonacci number: 20
The 20th Fibonacci number is: 6765
```

Justification :

This task helps us understand **how recursion works clearly and transparently**.

- The AI-generated code includes **base cases**, which prevent infinite recursion.
- Comments explain when the function stops and when it calls itself again.

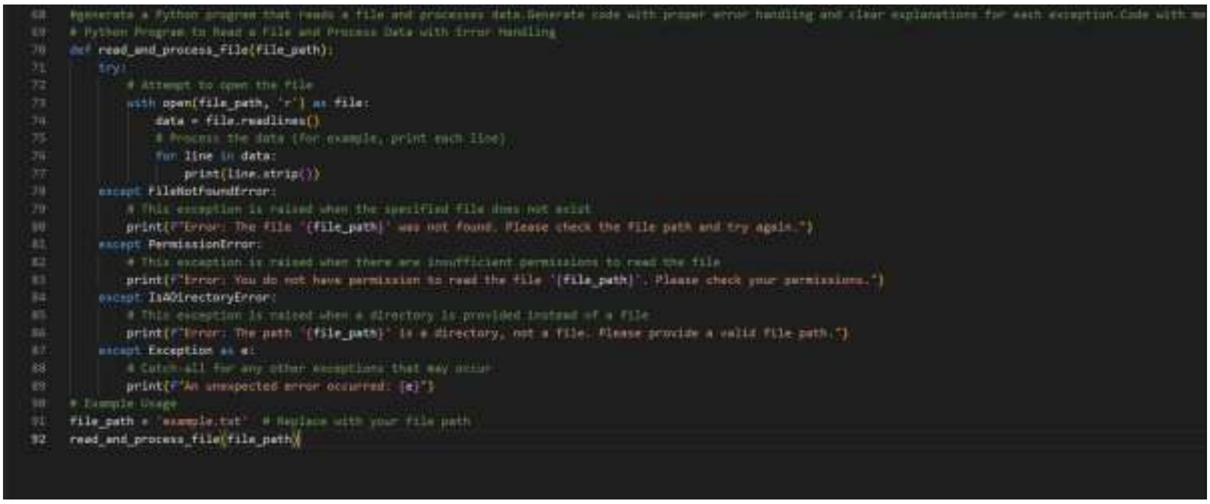
By adding clear explanations, the code becomes easier to understand and debug.
This improves **trust, learning, and correctness**, which are important in ethical AI coding.

Task 3: Transparency in Error Handling

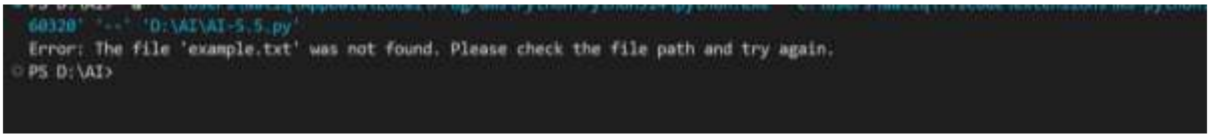
PROMPT :

Generate a Python program that reads a file and processes data.Generate code with proper error handling and clear explanations for each exception.Code with meaningful exception handling.Clear comments explaining each error scenario.Validation that explanations align with runtime behavior.

CODE and OUTPUT :



```python
#generate a Python program that reads a file and processes data.Generate code with proper error handling and clear explanations for each exception.Code with me
# Python Program to Read a File and Process Data with Error Handling
def read_and_process_file(file_path):
    try:
        # Attempt to open the file
        with open(file_path, 'r') as file:
            data = file.readlines()
            # Process the data (for example, print each line)
            for line in data:
                print(line.strip())
    except FileNotFoundError:
        # This exception is raised when the specified file does not exist
        print(f"Error: The file '{file_path}' was not found. Please check the file path and try again.")
    except PermissionError:
        # This exception is raised when there are insufficient permissions to read the file
        print(f"Error: You do not have permission to read the file '{file_path}'. Please check your permissions.")
    except IsADirectoryError:
        # This exception is raised when a directory is provided instead of a file
        print(f"Error: The path '{file_path}' is a directory, not a file. Please provide a valid file path.")
    except Exception as e:
        # Catch-all for any other exceptions that may occur
        print(f"An unexpected error occurred: {e}")
# Example Usage
file_path = 'example.txt'  # Replace with your file path
read_and_process_file(file_path)
```



```
60320' '--' 'D:\AI\AI-5.5.py'
Error: The file 'example.txt' was not found. Please check the file path and try again.
PS D:\AI>
```

Justification :

Proper error handling is important for **safe and reliable software**.

- The program handles common errors like missing files and permission issues.
- Each exception is explained so users know what went wrong.

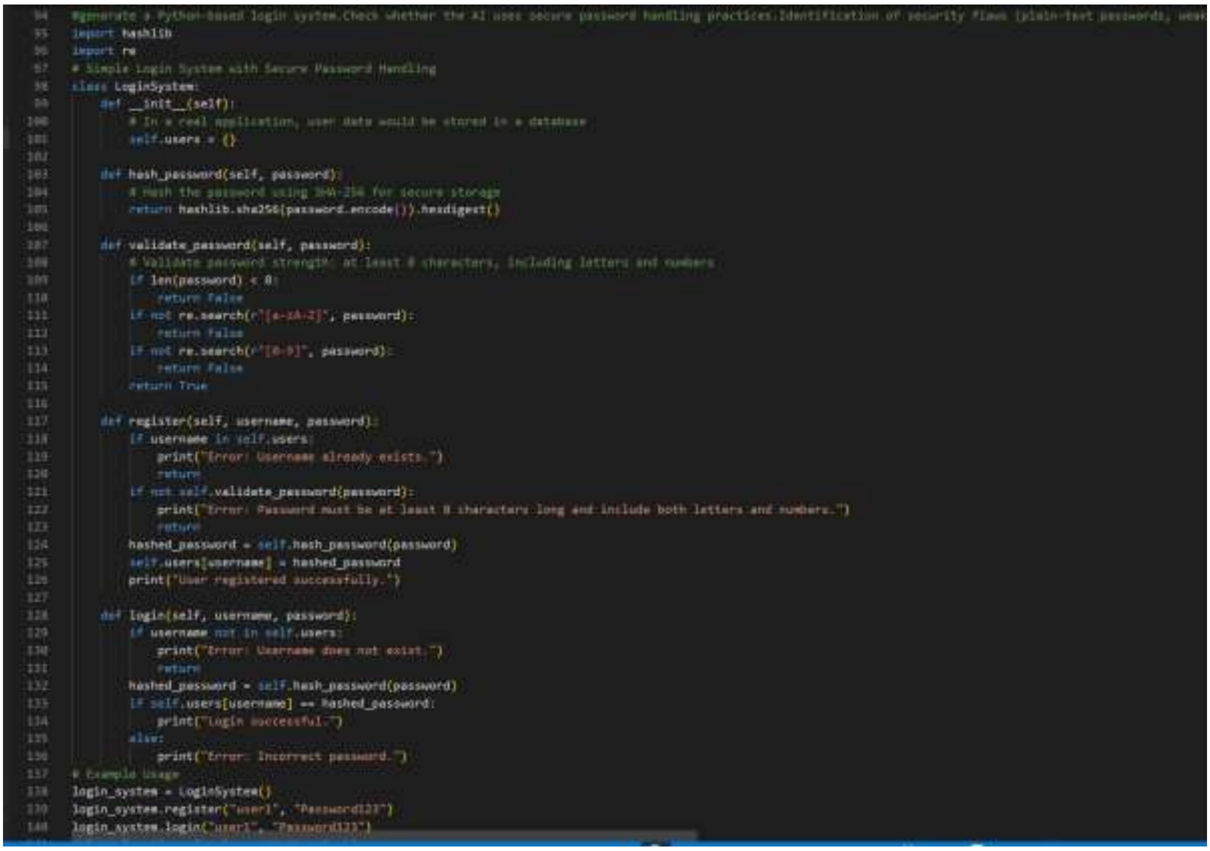
This task shows that AI-generated code must be **checked and improved** to avoid crashes and confusion.
Clear error messages increase transparency and user confidence.

Task 4: Security in User Authentication

PROMPT :

Generate a Python-based login system.Check whether the AI uses secure password handling practices.Identification of security flaws (plain-text passwords, weak validation).Revised version using password hashing and input validation.Short note on best practices for secure authentication.

CODE and OUTPUT :



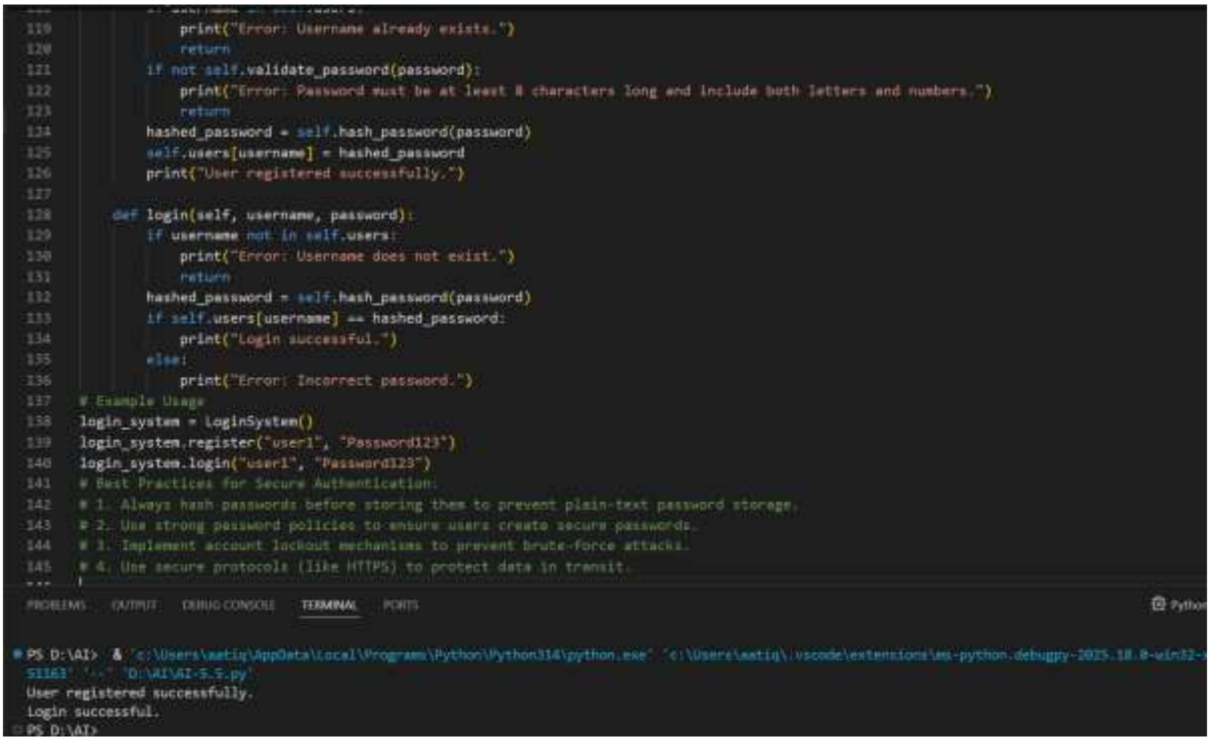
```
#generate a Python-based login system.Check whether the AI uses secure password handling practices.Identification of security flaws (plain-text passwords, weak
import hashlib
import re
# Simple Login System with Secure Password Handling
class LoginSystem:
    def __init__(self):
        # In a real application, user data would be stored in a database
        self.users = {}

    def hash_password(self, password):
        # Hash the password using SHA-256 for secure storage
        return hashlib.sha256(password.encode()).hexdigest()

    def validate_password(self, password):
        # Validate password strength: at least 8 characters, including letters and numbers
        if len(password) < 8:
            return False
        if not re.search(r"[a-zA-Z]", password):
            return False
        if not re.search(r"[0-9]", password):
            return False
        return True

    def register(self, username, password):
        if username in self.users:
            print("Error: Username already exists.")
            return
        if not self.validate_password(password):
            print("Error: Password must be at least 8 characters long and include both letters and numbers.")
            return
        hashed_password = self.hash_password(password)
        self.users[username] = hashed_password
        print("User registered successfully.")

    def login(self, username, password):
        if username not in self.users:
            print("Error: Username does not exist.")
            return
        hashed_password = self.hash_password(password)
        if self.users[username] == hashed_password:
            print("Login successful.")
        else:
            print("Error: Incorrect password.")
# Example Usage
login_system = LoginSystem()
login_system.register("user1", "Password123")
login_system.login("user1", "Password123")
```



```
            print("Error: Username already exists.")
            return
        if not self.validate_password(password):
            print("Error: Password must be at least 8 characters long and include both letters and numbers.")
            return
        hashed_password = self.hash_password(password)
        self.users[username] = hashed_password
        print("User registered successfully.")

    def login(self, username, password):
        if username not in self.users:
            print("Error: Username does not exist.")
            return
        hashed_password = self.hash_password(password)
        if self.users[username] == hashed_password:
            print("Login successful.")
        else:
            print("Error: Incorrect password.")
# Example Usage
login_system = LoginSystem()
login_system.register("user1", "Password123")
login_system.login("user1", "Password123")
# Best Practices for Secure Authentication:
# 1. Always hash passwords before storing them to prevent plain-text password storage.
# 2. Use strong password policies to ensure users create secure passwords.
# 3. Implement account lockout mechanisms to prevent brute-force attacks.
# 4. Use secure protocols (like HTTPS) to protect data in transit.
```

```
PS D:\AI> & 'c:\Users\aatiq\AppData\Local\Programs\Python\Python314\python.exe' 'c:\Users\aatiq\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x
51163' '--' 'D:\AI\AI-5.5.py'
User registered successfully.
Login successful.
PS D:\AI>
```

Justification:

This task highlights **security risks in AI-generated code**.

- The insecure version stores passwords in plain text, which is unsafe.

- The improved version uses **password hashing**, making it difficult for attackers to steal passwords.

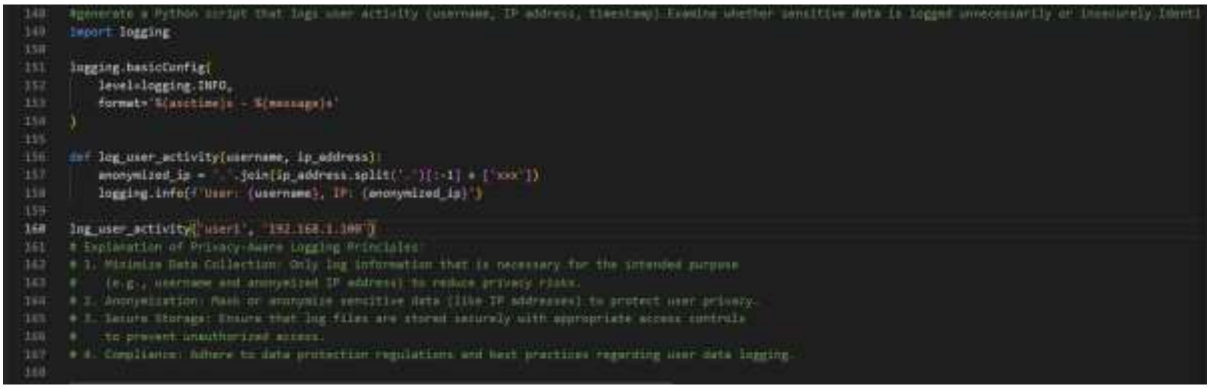
Developers must review AI code carefully to ensure it follows **secure coding practices**. Security is a key ethical responsibility when handling user data.

Task 5: Privacy in Data Logging

PROMPT :

Generate a Python script that logs user activity (username, IP address, timestamp).Examine whether sensitive data is logged unnecessarily or insecurely.Identified privacy risks in logging.Improved version with minimal, anonymized, or maskedlogging.Explanation of privacy-aware logging principles.

CODE and OUTPUT :

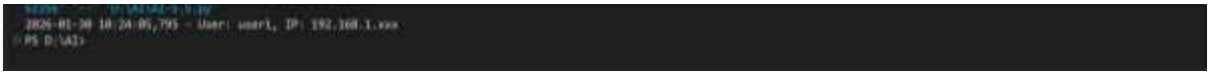


```
#generate a Python script that logs user activity (username, IP address, timestamp).Examine whether sensitive data is logged unnecessarily or insecurely.Identi
import logging

logging.basicConfig(
    level=logging.INFO,
    format='%(asctime)s - %(message)s'
)

def log_user_activity(username, ip_address):
    anonymized_ip = '.'.join(ip_address.split('.')[:-1] + ['xxx'])
    logging.info(f'User: {username}, IP: {anonymized_ip}')

log_user_activity('user1', '192.168.1.100')
# Explanation of Privacy-Aware Logging Principles:
# 1. Minimize Data Collection: Only log information that is necessary for the intended purpose
#    (e.g., username and anonymized IP address) to reduce privacy risks.
# 2. Anonymization: Mask or anonymize sensitive data (like IP addresses) to protect user privacy.
# 3. Secure Storage: Ensure that log files are stored securely with appropriate access controls
#    to prevent unauthorized access.
# 4. Compliance: Adhere to data protection regulations and best practices regarding user data logging.
```



```
[illegible]
2026-01-30 10:24:05,795 - User: user1, IP: 192.168.1.xxx
PS D:\AI>
```

Justification:

This task focuses on **user privacy and data protection**.

- Logging full usernames and IP addresses can expose sensitive information.
- The improved version masks user data and logs only what is necessary.

This follows the principle of **data minimization**, which helps protect user privacy.
Ethical AI coding requires respecting personal data and avoiding unnecessary data collection.