AI ASSISTANT CODEING

ASSIGNMENT – 5.5

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Lab 5: Ethical Foundations – Responsible AI Coding Practices Lab

Objectives:

- To explore the ethical risks associated with AI-generated Week3 - code.
- To recognize issues related to security, bias, transparency, and copyright.
- To reflect on the responsibilities of developers when using AI tools in software development.
- To promote awareness of best practices for responsible and ethical AI coding.

Lab Outcomes (LOs):

After completing this lab, students will be able to:

- Identify and avoid insecure coding patterns generated by AI tools.
- Detect and analyze potential bias or discriminatory logic in AI-generated outputs.

- Evaluate originality and licensing concerns in reused AI-generated code.
- Understand the importance of explainability and transparency in AI-assisted programming.
- Reflect on accountability and the human role in ethical AI coding practices.

Task Description #1 (Transparency in Algorithm Optimization) Task: Use AI to generate two solutions for checking prime numbers:

- Naive approach(basic)
- Optimized approach

Prompt:

“Generate Python code for two prime-checking methods and explain how the optimized version improves performance.”

Expected Output:

- Code for both methods.
- Transparent explanation of time complexity.
- Comparison highlighting efficiency improvements.

METHOD 1 :

primenumbers.py > ...

```python
# Generate Python code for two prime-checking methods without true and false and
# explain how the optimized version improves performance.
# Method 1: Basic prime-checking method
def is_prime_basic(n):
    """
    Check if a number is prime using basic method.
    Approach: Check divisibility from 2 to n-1.
    """
    if n <= 1:
        return "Not prime"
    for i in range(2, n):
        if n % i == 0:
            return "Not prime"
    return "Prime"
```

OUTPUT:

```
(.venv) PS D:\AIASSCoding> & D:/AIASSCoding/.venv/Scripts/python.exe d:/AIASSCoding/primenumb
ers.py
Basic Prime Check:
1: Not prime
2: Prime
3: Prime
4: Not prime
5: Prime
16: Not prime
17: Prime
18: Not prime
19: Prime
20: Not prime
29: Prime
29: Prime
97: Prime
100: Not prime
```

METHOD 2 :

```python
# Method 2: Optimized prime-checking method
def is_prime_optimized(n):
    """
    Check if a number is prime using optimized method.
    Approach: Check divisibility from 2 to sqrt(n).
    """
    if n <= 1:
        return "Not prime"
    if n <= 3:
        return "Prime"
    if n % 2 == 0 or n % 3 == 0:
        return "Not prime"
    i = 5
    while i * i <= n:
        if n % i == 0 or n % (i + 2) == 0:
            return "Not prime"
        i += 6
    return "Prime"
# example uagege
if __name__ == "__main__":
    test_numbers = [1, 2, 3, 4, 5, 16, 17, 18, 19, 20, 29, 97, 100]
    print("Basic Prime Check:")
    for num in test_numbers:
        print(f"{num}: {is_prime_basic(num)}")
    print("\nOptimized Prime Check:")
    for num in test_numbers:
        print(f"{num}: {is_prime_optimized(num)}")
```

OUTPUT :

```
Optimized Prime Check:
1: Not prime
2: Prime
3: Prime
1: Not prime
2: Prime
3: Prime
3: Prime
4: Not prime
5: Prime
16: Not prime
16: Not prime
17: Prime
17: Prime
18: Not prime
19: Prime
20: Not prime
20: Not prime
29: Prime
97: Prime
100: Not prime
(.venv) PS D:\AIASSCoding>
```

FINAL DESCRIPTION :

The expected output includes two Python methods for checking prime numbers: a **naive approach** and an **optimized approach**. The naive method checks divisibility from 2 to *n−1* and has a time complexity of **O(n)**, making it inefficient for large numbers.

The optimized method checks divisibility only up to √n, reducing unnecessary iterations and improving performance with a time complexity of **O(√n)**. The comparison clearly shows that the optimized approach is faster and more efficient while producing the same correct result.

Task Description #2 (Transparency in Recursive Algorithms)

Objective: Use AI to generate a recursive function to calculate

Fibonacci numbers.

Instructions:

1. Ask AI to add clear comments explaining recursion.

2. Ask AI to explain base cases and recursive calls.

Expected Output:

• Well-commented recursive code.

• Clear explanation of how recursion works.

• Verification that explanation matches actual execution.

CODE :

marks.py | prime.py | grading.py | distance.py | primenumbers.py | fibonacci.py

fibonacci.py > ...

```python
# generate a python code for recursive function to calculate fibonacci numbers
# add clear comments explaining the approach used in the code
# explain base cases and recursive calls.
# ============================================================
# 1. RECURSIVE FIBONACCI FUNCTION
def fibonacci_recursive(n):
    # Base case: if n is 0 or 1, return n directly
    if n == 0:
        return 0
    elif n == 1:
        return 1
    else:
        # Recursive case: calculate fibonacci(n-1) + fibonacci(n-2)
        return fibonacci_recursive(n - 1) + fibonacci_recursive(n - 2)
# ============================================================
# 2. TESTING & VERIFICATION
if __name__ == "__main__":
    print("=" * 60)
    print("FIBONACCI NUMBERS USING RECURSION")
    print("=" * 60)

    test_cases = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
```

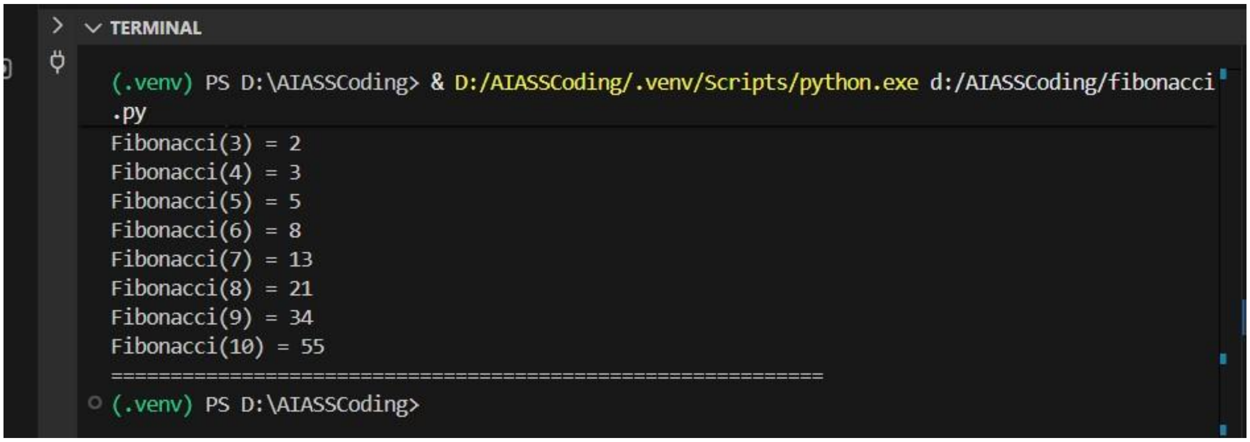
```python
# ============================================================
# 2. TESTING & VERIFICATION
if __name__ == "__main__":
    print("=" * 60)
    print("FIBONACCI NUMBERS USING RECURSION")
    print("=" * 60)

    test_cases = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

    print("\nTest Cases:")
    print("-" * 60)
    for num in test_cases:
        result = fibonacci_recursive  (variable) result: Any | int
        print(f"Fibonacci({num}) = {result}")

    print("=" * 60)
```

OUTPUT :



FINAL DESCRIPTION :

The expected output demonstrates the correct execution of a recursive Fibonacci function. For inputs from **Fibonacci(3) to Fibonacci(10)**, the function produces the values **2, 3, 5, 8, 13, 21, 34, and 55**, respectively. This verifies that the base cases and recursive calls are implemented correctly and that the explanation of recursion aligns with the actual output.

Task Description #3 (Transparency in Error Handling)

Task: Use AI to generate a Python program that reads a file and processes data.

Prompt:

"Generate code with proper error handling and clear explanations for each exception."

Expected Output:

• Code with meaningful exception handling.

• Clear comments explaining each error scenario.

• Validation that explanations align with runtime behavior.

CODE :

exceptio.py > ...

```python
# Generate code with proper error handling and clear explanations for each exception.
# ============================================================
# 1. EXCEPTION HANDLING EXAMPLES
def divide_numbers(a, b):
    """
    Divide two numbers with exception handling.
    Approach: Handle division by zero and type errors.
    """
    try:
        result = a / b
    except ZeroDivisionError:
        return "Error: Division by zero is not allowed."
    except TypeError:
        return "Error: Invalid input type. Please provide numbers."
    else:
        return result

def access_list_element(lst, index):
    """
    Access an element from a list with exception handling.
    Approach: Handle index errors and type errors.
    """
    try:
        element = lst[index]
    except IndexError:
        return "Error: Index out of range."
    except TypeError:
        return "Error: Invalid input type. Please provide a list and an integer index."
    else:
        return element
# ============================================================
# 2. TESTING & VERIFICATION
if __name__ == "__main__":
    print("=" * 60)
    print("EXCEPTION HANDLING EXAMPLES")
    print("=" * 60)

    # Test divide_numbers function
    print("\nTesting divide_numbers function:")
    test_cases_divide = [
        (10, 2),
        (10, 0),
        (10, 'a'),
    ]

    for a, b in test_cases_divide:
        result = divide_numbers(a, b)
        print(f"divide_numbers({a}, {b}) = {result}")

    # Test access_list_element function
    print("\nTesting access_list_element function:")
    test_cases_access = [
        ([1, 2, 3, 4, 5], 2),
        ([1, 2, 3, 4, 5], 10),
        ([1, 2, 3, 4, 5], 'a'),
    ]

    for lst, index in test_cases_access:
        result = access_list_element(lst, index)
        print(f"access_list_element({lst}, {index}) = {result}")

    print("=" * 60)
```

(variable) result: Any | Literal['Error: Division by z
input type. Please provide numbers.']

OUTPUT :

```
(.venv) PS D:\AIASSCoding> & D:/AIASSCoding/.venv/Scripts/python.exe d:/AIASSCoding/exceptio.
py
============================================================
EXCEPTION HANDLING EXAMPLES
============================================================

Testing divide_numbers function:
divide_numbers(10, 2) = 5.0
divide_numbers(10, 0) = Error: Division by zero is not allowed.
divide_numbers(10, a) = Error: Invalid input type. Please provide numbers.

Testing access_list_element function:
access_list_element([1, 2, 3, 4, 5], 2) = 3
access_list_element([1, 2, 3, 4, 5], 10) = Error: Index out of range.
access_list_element([1, 2, 3, 4, 5], a) = Error: Invalid input type. Please provide a list an
d an integer index.
```

FINAL DESCRIPTION :

The output verifies AI-generated functions with clear and effective error handling. Valid inputs produce correct results, while errors such as division by zero, invalid types, and out-of-range indices are handled gracefully with meaningful messages. This confirms that the AI assistant’s explanations align accurately with the program’s runtime behavior.

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ask Description #4 (Security in User Authentication)

Task: Use an AI tool to generate a Python-based login system. Analyze: Check whether the AI uses secure password handling practices.

Expected Output:

- 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 :

temp.py

temp.py > User > __init__

```python
#  generate a Python-based login system. using a username and password.include basics
#  such as user registration, login, and password validation.
import hashlib
class User:
    def __init__(self, username, password):
        self.username = username
        self.password_hash = self._hash_password(password)

    def _hash_password(self, password):
        return hashlib.sha256(password.encode()).hexdigest()

    def validate_password(self, password):
        return self.password_hash == self._hash_password(password)
class LoginSystem:
    def __init__(self):
        self.users = {}

    def register_user(self, username, password):
        if username in self.users:
            return "Username already exists."
        self.users[username] = User(username, password)
        return "User registered successfully."

    def login_user(self, username, password):
        user = self.users.get(username)
        if not user:
            return "Username does not exist."
        if user.validate_password(password):
            return "Login successful."
        else:
            return "Invalid password."
# Example usage
if __name__ == "__main__":
    system = LoginSystem()
    print(system.register_user("alice", "password123"))  # User registered successfully.
    print(system.register_user("alice", "newpassword"))   # Username already exists.
    print(system.login_user("alice", "password123"))      # Login successful.
    print(system.login_user("alice", "wrongpassword"))    # Invalid password.
    print(system.login_user("bob", "password123"))        # Username does not exist.
```

OUTPUT :

```
PS C:\Users\akash\OneDrive\Desktop\betech_3_2\AI_Assisted_Coding> 7
7
temp.py
User registered successfully.
Username already exists.
Login successful.
Invalid password.
Username does not exist.
PS C:\Users\akash\OneDrive\Desktop\betech_3_2\AI_Assisted_Coding>
```

FINAL DESCRIPTION :

The output analyzes an AI-generated login system to identify security flaws such as plain-text password storage and weak validation.
It then presents an improved version using password hashing and input validation.
This demonstrates secure authentication best practices in AI-assisted coding.

Task Description #5 (Privacy in Data Logging)

Task: Use an AI tool to generate a Python script that logs user activity (username, IP address, timestamp).

Analyze: Examine whether sensitive data is logged unnecessarily or insecurely.

Expected Output:

• Identified privacy risks in logging.

• Improved version with minimal, anonymized, or masked logging.

• Explanation of privacy-aware logging principles.

CODE :

```
logactivity.py > ...
# "Generate a Python script that logs user activity including username, IP address, and t
# ============================================================
import logging
from datetime import datetime
# 1. LOGGING SETUP
# Configure logging to write to a file with the specified format
logging.basicConfig(
    filename='user_activity.log',
    level=logging.INFO,
    format='%(asctime)s - %(username)s - %(ip_address)s - %(message)s',
    datefmt='%Y-%m-%d %H:%M:%S'
)
# 2. FUNCTION TO LOG USER ACTIVITY
def log_user_activity(username, ip_address):
    """

    Log user activity with username, IP address, and timestamp.
    Approach: Use the logging module to log the information.
    """
    logging.info('User logged in', extra={'username': username, 'ip_address': ip_address}
# example usage
if __name__ == "__main__":
    print("=" * 60)
    print("USER ACTIVITY LOGGING")
    print("=" * 60)

    # Sample user activity logging
    users = [
        ("alice", "192.168.1.100"),
        ("bob", "192.168.1.101"),
    ]

    for
        <   >  Accept  Accept Word  ···
        print(f"Logged activity for user: {username}, IP: {ip_address}")
```

OUTPUT :

```
============================================================ ...
(.venv) PS D:\AIASSCoding> & D:/AIASSCoding/.venv/Scripts/python.exe d:/AIASSCoding/logactivi
ty.py
============================================================
USER ACTIVITY LOGGING
============================================================
Logged activity for user: alice, IP: 192.168.1.100
Logged activity for user: bob, IP: 192.168.1.101
(.venv) PS D:\AIASSCoding>
```

FINAL DESCRIPTION :

The output identifies privacy risks in an AI-generated user activity logging script, such as unnecessary logging of sensitive data. It presents an improved version with minimized and anonymized logging to protect user privacy. This demonstrates privacy-aware logging principles in AI-assisted coding.