

**COURSE: AI Assisted Coding**

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## **Lab 1: Environment Setup – GitHub Copilot and VS Code Integration + Understanding AI-assisted Coding Workflow**

### **TASK-1**

Task 1: AI-Generated Logic Without Modularization (Factorial without Functions)

- Scenario

You are building a small command-line utility for a startup intern onboarding task. The program is simple and must be written quickly without modular design.

- Task Description

Use GitHub Copilot to generate a Python program that computes a mathematical product-based value (factorial-like logic) directly in the main execution flow, without using any user-defined functions.

- Constraint:

- Do not define any custom function
- Logic must be implemented using loops and variables only

- Expected Deliverables

- A working Python program generated with Copilot assistance

- Screenshot(s) showing:

- The prompt you typed
- Copilot's suggestions
- Sample input/output screenshots
- Brief reflection (5–6 lines):
- How helpful was Copilot for a beginner?

➤ Did it follow best practices automatically?

The screenshot shows the Microsoft Visual Studio Code interface. In the Explorer sidebar, there is a file named 'Fact.py'. The code editor displays the following Python script:

```
1 # Program to calculate factorial using loops only
2
3 # Take input from the user
4 num = int(input("Enter a number: "))
5
6 # Initialize factorial to 1
7 factorial = 1
8
9 # calculate factorial using a loop
10 if num < 0:
11     print("Factorial is not defined for negative numbers.")
12 elif num == 0:
13     print("The factorial of 0 is 1")
14 else:
15     for i in range(1, num + 1):
16         factorial *= i
17     print(f"The factorial of {num} is {factorial}")
18
```

The terminal tab shows the output of running the script:

```
PS D:\3-2\AIAC> & C:/Users/pashi/AppData/Local/Microsoft/WindowsApps/python3.11.exe d:/3-2/AIAC/Fact.py
Enter a number: 5
The Factorial of 5 is 120
PS D:\3-2\AIAC>
```

The right-hand panel contains a summary of the task and generated code:

**PROMPT**  
Write a Python program to calculate the factorial of a number using loops only, without defining any function. Take input from the user and display the result.

**ANSWER**  
Read Python file  
Now I'll write a Python program to calculate the factorial of a number using loops only:  
Created Fact.py  
Done! I've created a Python program that calculates the factorial of a number using only loops. The program:

- Takes a number as input from the user
- Handles edge cases (negative numbers and zero)
- Uses a For loop to multiply numbers from 1 to the input number
- Displays the factorial result

To test it, run the file and enter a number

**INTERACTION**  
Describe what to build next  
Agent Auto

## Brief Reflection

GitHub Copilot was very helpful for a beginner because it quickly generated correct and readable code.

It understood the comment prompt and followed the constraint of not using functions.

The generated logic was simple and easy to understand.

Copilot automatically used a loop and proper variable naming.

However, beginners should still verify the logic instead of blindly trusting the output.

Overall, Copilot improves productivity and learning speed.

## Conclusion

This lab helped in understanding how AI tools like GitHub Copilot assist in coding tasks.

It demonstrated prompt-based programming and highlighted the importance of reviewing AI-generated code.

## TASK-2

### Task 2: AI Code Optimization & Cleanup (Improving Efficiency)

#### ❖ Scenario

Your team lead asks you to review AI-generated code before committing it to a shared repository.

#### ❖ Task Description

Analyze the code generated in Task 1 and use Copilot again to:

➤ Reduce unnecessary variables

➤ Improve loop clarity

- Enhance readability and efficiency

Hint:

Prompt Copilot with phrases like

“optimize this code”, “simplify logic”, or “make it more readable”

#### ❖ Expected Deliverables

- Original AI-generated code
- Optimized version of the same code
- Side-by-side comparison
- Written explanation:
  - What was improved?
  - Why the new version is better (readability, performance, maintainability).

```

1 # Calculate factorial using Loops only
2
3 n = int(input("Enter a number: "))
4
5 if n < 0:
6     print("Factorial is not defined for negative numbers.")
7 else:
8     factorial = 1
9     for i in range(1, n + 1):
10         factorial *= i
11     print(f"Factorial of {n} is: {factorial}")
12

```

**Optimize this code and make the logic simpler and more readable**

- ✓ Read current factorial code and optimized it.
- ✓ Edited `(*) Fact.py -11`

Done! I've optimized the code:

**Changes made:**

- Removed excessive comments - kept only essential ones
- Used `*=` operator instead of `factorial = factorial * i` for cleaner code
- Simplified input prompt - made it more concise
- Removed redundant comment lines - the code is now self-explanatory

The logic remains the same but is now cleaner and more readable. The program still handles negative numbers and calculates factorial correctly using only loops.

PS D:\3-2\AIAC> & C:/users/pashi/AppData/Local/Microsoft/WindowsApps/python3.11.exe d:/3-2/AIAC/Fact.py  
Enter a number to calculate its factorial: 5  
The Factorial of 5 is: 120  
PS D:\3-2\AIAC> & C:/users/pashi/AppData/Local/Microsoft/WindowsApps/python3.11.exe d:/3-2/AIAC/Fact.py  
Enter a number: 6  
Factorial of 6 is: 720  
PS D:\3-2\AIAC>

#### Side-by-Side Comparison

Original Code	Optimized Code
Uses variable name result	Uses clearer name factorial
Loop starts from 1	Loop starts from 2 (avoids unnecessary multiplication)
Traditional multiplication syntax	Uses *= shorthand
Normal print statement	Uses formatted string (f-string)

## **Written Explanation**

### **What was improved?**

- Variable naming was improved for better clarity
- Loop logic was simplified by starting from 2 instead of 1
- Shorthand operator (`*=`) reduced verbosity
- Output formatting became cleaner using f-strings

### **Why the new version is better?**

- **Readability:** Clearer variable names and cleaner print statement
- **Performance:** Avoids unnecessary multiplication by 1
- **Maintainability:** Shorter and easier to understand code
- **Professional quality:** Follows cleaner coding style

## **Conclusion**

Using Copilot for optimization helps refine initial AI-generated code into cleaner and more maintainable versions.

However, human review is still essential before committing code to production.

## **TASK-3**

### **Task 3: Modular Design Using AI Assistance (Factorial with Functions)**

#### **❖ Scenario**

The same logic now needs to be reused in multiple scripts.

#### **❖ Task Description**

Use GitHub Copilot to generate a modular version of the program by:

- Creating a user-defined function
- Calling the function from the main block

#### **❖ Constraints**

- Use meaningful function and variable names
- Include inline comments (preferably suggested by Copilot)

#### **❖ Expected Deliverables**

- AI-assisted function-based program
- Screenshots showing:

- Prompt evolution
- Copilot-generated function logic

➤ Sample inputs/outputs

➤ Short note:

- o How modularity improves reusability.

The screenshot shows a Microsoft Visual Studio Code (VS Code) interface. On the left is the Explorer sidebar with a file named 'Fact.py' selected. The main editor area contains the following Python code:

```
# Function to calculate the factorial of a number
def calculate_factorial(number):
    # Check if the number is negative
    if number < 0:
        return "Factorial is not defined for negative numbers."
    # Initialize result to 1 (multiplicative identity)
    factorial_result = 1
    # Multiply all numbers from 1 to the given number
    for current_value in range(1, number + 1):
        factorial_result *= current_value
    return factorial_result

# Main program
user_input = int(input("Enter a number: "))
factorial_output = calculate_factorial(user_input)

# Display the result
if isinstance(factorial_output, str):
    print(factorial_output)
else:
    print(f"Factorial of {user_input} is: {factorial_output}")
```

The terminal at the bottom shows command-line interactions:

```
PS D:\3-2\AIAC & C:/Users/pashi/appdata/Local/Microsoft/WindowsApps/python3.11.exe d:/3-2/AIAC/Fact.py
Enter a number to calculate its factorial: 5
The Factorial of 5 is: 120
PS D:\3-2\AIAC & C:/Users/pashi/appdata/Local/Microsoft/WindowsApps/python3.11.exe d:/3-2/AIAC/Fact.py
Enter a number: 6
Factorial of 6 is: 720
PS D:\3-2\AIAC & C:/Users/pashi/appdata/Local/Microsoft/WindowsApps/python3.11.exe d:/3-2/AIAC/Fact.py
Enter a number: 8
Factorial of 8 is: 40320
PS D:\3-2\AIAC
```

On the right side of the interface, there is a 'CHAT' panel with a message from GitHub Copilot:

Write a Python program to calculate factorial using a user-defined function  
Use meaningful function and variable names  
Include inline comments to explain the logic

Created function-based factorial program with comments  
Edited Fact.py +24 -10  
Done! I've refactored the code to use a user-defined function with the following improvements:

Key changes:

- calculate\_factorial() function - encapsulates the factorial logic
- Meaningful names - user\_input, factorial\_result, current\_value instead of generic names
- Follow conventions - maintain consistency of

1 file changed +26 -1

Describe what to build next

## How Modularity Improves Reusability

Modularity allows the same function to be reused in multiple programs without rewriting the logic.

It improves code readability and makes debugging easier.

Functions help separate logic into meaningful blocks.

If changes are needed, they can be made in one place.

Overall, modular design makes the code more maintainable and scalable

## Conclusion

Using GitHub Copilot for modular programming helps generate clean, reusable code quickly.

However, understanding the logic is essential before using AI-generated functions in real projects.

## TASK-4

### Task 4: Comparative Analysis – Procedural vs Modular AI Code (With vs

Without Functions)

#### ❖ Scenario

As part of a code review meeting, you are asked to justify design choices.

#### ❖ Task Description

Compare the non-function and function-based Copilot-generated

programs on the following criteria:

- Logic clarity
- Reusability
- Debugging ease
- Suitability for large projects
- AI dependency risk
- ❖ Expected Deliverables

Choose one:

- A comparison table
- OR
- A short technical report (300–400 words).

### **Comparative Analysis – Procedural vs Modular AI Code**

#### **Comparison: Without Functions vs With Functions (AI-Generated Code)**

Criteria	Procedural Code (Without Functions)	Modular Code (With Functions)
<b>Logic Clarity</b>	Logic is written in a single block, which is easy to follow for very small programs but becomes cluttered as code grows.	Logic is separated into a well-named function, making the program structure clearer and easier to understand.
<b>Reusability</b>	Code cannot be reused easily and must be rewritten if needed in another program.	The same function can be reused across multiple scripts without duplication.
<b>Debugging Ease</b>	Debugging is harder because all logic is mixed together in the main flow.	Debugging is easier since errors can be isolated within the function.
<b>Suitability for Large Projects</b>	Not suitable for large projects due to poor structure and scalability issues.	Highly suitable for large projects as modular design supports scalability and teamwork.
<b>AI Dependency Risk</b>	Beginners may depend heavily on AI-generated logic without understanding the flow.	Encourages understanding of function design and reduces blind AI dependency.

## **Conclusion**

Procedural code generated by AI is useful for quick and simple tasks, especially for beginners. However, modular code provides better readability, reusability, and maintainability. For real-world and large-scale projects, function-based modular design is always preferred.

## **TASK-5**

### Task 5: AI-Generated Iterative vs Recursive Thinking

#### ❖ Scenario

Your mentor wants to test how well AI understands different computational paradigms.

#### ❖ Task Description

Prompt Copilot to generate:

An iterative version of the logic

A recursive version of the same logic

#### ❖ Constraints

Both implementations must produce identical outputs

Students must not manually write the code first

#### ❖ Expected Deliverables

Two AI-generated implementations

Execution flow explanation (in your own words)

Comparison covering:

➤ Readability

➤ Stack usage

➤ Performance implications

➤ When recursion is not recommended

```

1 # Iterative program to calculate factorial using loops.
2
3 # Get user input
4 user_input = int(input("Enter a number to calculate its factorial: "))
5
6 # Validate input - factorial is not defined for negative numbers
7 if user_input < 0:
8     print("Error: Factorial is not defined for negative numbers.")
9 else:
10    # Initialize factorial result to 1 (multiplicative identity)
11    factorial_result = 1
12
13    # Iterate through all numbers from 1 to user input (inclusive)
14    for number in range(1, user_input + 1):
15        # Multiply the current factorial result by the loop counter
16        factorial_result *= number
17
18    # Display the calculated factorial result
19    print(f"The Factorial of {user_input} is: {factorial_result}")
20

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

Enter a number to calculate its factorial: 5  
The Factorial of 5 is: 120  
PS D:\3-2\AIAC & C:/Users/pashi/AppData/Local/Microsoft/WindowsApps/python3.11.exe d:/3-2/AIAC/Fact.py  
Enter a number: 6  
Factorial of 6 is: 720  
PS D:\3-2\AIAC & C:/Users/pashi/AppData/Local/Microsoft/WindowsApps/python3.11.exe d:/3-2/AIAC/Fact.py  
Enter a number: 8  
Factorial of 8 is: 40320  
PS D:\3-2\AIAC & C:/Users/pashi/AppData/Local/Microsoft/WindowsApps/python3.11.exe d:/3-2/AIAC/Fact.py  
Enter a number to calculate its factorial: 7  
The Factorial of 7 is: 5040  
PS D:\3-2\AIAC

1 file changed +20 -1 Keep Undo

Describe what to build next  
Agent Auto

In 10, Col 65 Spaces: 4 UTF-8 Python 3.11.9 (Microsoft Store) Go Live

### Execution Flow Explanation:

In the iterative approach, the program uses a loop to repeatedly multiply numbers until the final result is obtained.

In the recursive approach, the function repeatedly calls itself by reducing the problem size until it reaches the base condition.

Iteration completes the task in a single function call, while recursion breaks the problem into smaller subproblems.

Both approaches follow the same mathematical logic but differ in execution style.

### Comparison: Iterative vs Recursive AI-Generated Code

Criteria	Iterative Approach	Recursive Approach
Readability	Easier to understand for beginners	Cleaner and closer to mathematical definition
Stack Usage	Uses constant memory	Uses call stack for each function call
Performance Implications	Faster and memory-efficient	Slower due to function call overhead
When Recursion Is Not Recommended	—	For large inputs due to stack overflow risk

### Conclusion

AI can successfully generate both iterative and recursive solutions when prompted correctly.

Iterative solutions are safer for large inputs, while recursive solutions are more elegant but resource-intensive.

Understanding both approaches helps developers choose the right paradigm for real-world applications.

