

AI Assisted Coding

Assignment - 01

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

Task 1: AI-Generated Logic Without Modularization (Fibonacci Sequence Without Functions)

❖ **Scenario :** You are asked to write a quick numerical sequence generator for a learning platform prototype.

- **Prompt used :**

```
# Write a Python program to generate the Fibonacci sequence up to n terms # Take user input for n # Implement the logic directly in the main program # Do not use any user-defined functions # Print the Fibonacci sequence.
```

- **Generated code :**

```
try:  
    n = int(input("Enter the number of terms: "))  
except ValueError:  
    print("Please enter a valid integer")  
    raise SystemExit  
  
if n <= 0:  
    print("Please enter a positive integer")  
else:  
    prev, curr = 0, 1  
    print(f"Fibonacci sequence up to {n} terms:")  
    for i in range(n):  
        end = " " if i < n - 1 else "\n"  
        print(prev, end=end)  
        prev, curr = curr, prev + curr
```

- **Sample Input :**

Enter no of terms : 5

- **Sample Output :**

Fibonacci sequence up to 5 terms:

0 1 1 2 3

- **Short Explanation of Logic :**

The program first takes an integer **n** as input from the user, which represents the number of Fibonacci terms to be printed. It initializes the first two Fibonacci numbers as **0** and **1**. Using a **loop**, the program prints each term and updates the values by adding the previous two numbers to generate the next term in the sequence. The entire logic is written directly in the main program without using any user-defined functions.

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

- ❖ **Scenario :**The prototype will be shared with other developers and needs optimization.

- **Prompt used :**

```
# Optimize this Fibonacci code # Simplify variable usage # Improve readability and efficiency.
```

- **Generated code :**

```
try:  
    n = int(input("Enter the number of terms: "))  
except ValueError:  
    print("Please enter a valid integer")  
    raise SystemExit  
  
if n <= 0:  
    print("Please enter a positive integer")  
else:  
    prev, curr = 0, 1  
    print(f"Fibonacci sequence up to {n} terms:")  
    for i in range(n):  
        end = " " if i < n - 1 else "\n"  
        print(prev, end=end)  
        prev, curr = curr, prev + curr
```

- **Sample Input :**

Enter the number of terms: 5

- **Sample Output :**

Fibonacci sequence up to 5 terms:

0 1 1 2 3

- **Short Explanation of Logic :**

The optimized program improves the original Fibonacci code by removing unnecessary variables and simplifying the loop logic. It generates each Fibonacci number using only the previous two values, avoiding redundant calculations. This makes the code more readable, efficient, and easier to understand while producing the same correct output.

Task 3: Modular Design Using AI Assistance (Fibonacci Using Functions)

❖ **Scenario :**The Fibonacci logic is now required in multiple modules of an application.

- **Prompt used :**

```
# Write a Python program using a function to generate Fibonacci sequence # The  
function should take n as input # Include meaningful comments
```

- **Generated code :**

```
"""  
task3.py
```

Generate Fibonacci sequence using a function.

The function `fibonacci(n)` returns a list containing the first `n` Fibonacci numbers (starting from 0). The main code reads `n` from standard input, validates it, and prints the sequence.

```
def fibonacci(n):  
    """Return the first n Fibonacci numbers as a list.
```

Args:

n (int): Number of terms to generate. If n <= 0, an empty list is returned.

Returns:

list[int]: List of Fibonacci numbers of length n.

```
"""
```

```
if n <= 0:  
    return []  
if n == 1:  
    return [0]
```

```
seq = [0, 1]  
while len(seq) < n:  
    seq.append(seq[-1] + seq[-2])  
return seq
```

```
if __name__ == "__main__":  
    try:  
        n = int(input("Enter the number of terms: "))  
    except ValueError:  
        print("Please enter a valid integer")  
        raise SystemExit
```

```
if n <= 0:  
    print("Please enter a positive integer")  
else:  
    # Generate and print the sequence on one line, space-separated  
    seq = fibonacci(n)  
    print(f"Fibonacci sequence up to {n} terms:")  
    print(" ".join(str(x) for x in seq))
```

- **Sample Input :**

Enter the number of terms: 5

- **Sample Output :**

Fibonacci sequence up to 5 terms:

0 1 1 2 3

- **Short Explanation of Logic :**

The program defines a user-defined function that generates the Fibonacci sequence up to n terms. The main program takes input from the user and calls this function. Inside the function, the Fibonacci numbers are calculated using a loop and printed (or returned). Using a function makes the code modular, reusable, and easier to maintain.

Task 4: Comparative Analysis – Procedural vs Modular Fibonacci Code

- ❖ **Scenario :** You are participating in a code review session.

- **Prompt used :**
- **Prompt 1: Basic Comparison**

Compare a Fibonacci program written without functions and a Fibonacci program written using functions.

Analyze the comparison in terms of:

- Code clarity
- Reusability
- Ease of debugging
- Suitability for larger systems

Provide the answer in simple academic language.

- **Prompt 2: Table Format**

Create a comparison table between procedural Fibonacci code (without functions) and modular Fibonacci code (with functions). Include parameters such as code clarity, reusability, debugging ease, and scalability.

- **Prompt 3: Short Analytical Explanation**

Write a short analytical report comparing procedural and modular Fibonacci implementations. Explain which approach is better and why. Limit the explanation to 5–6 lines.

- **Sample Output :**

Comparison (Fibonacci Programs)

Code clarity: Functions: named blocks (e.g., fib(n)) separate intent from implementation, so the main flow is concise and easy to read; No functions: everything is inline, which can be fine for very short scripts but becomes harder to follow as logic grows.

Reusability: Functions: easily reused, imported, and called with different arguments; No functions: logic is tied to the script and must be copied or refactored to reuse.

Ease of debugging: Functions: let you test and isolate small units (unit tests, step-through debugging) so locating bugs is simpler; No functions: debugging requires examining the whole linear flow and is more error-prone.

Suitability for larger systems: Functions: enable modular design, easier maintenance, and integration into larger codebases; No functions: poor scalability—hard to extend, test, or integrate into services or libraries.

Procedural vs Modular Fibonacci — short analytical report :

Procedural implementations keep logic inline, making very small scripts straightforward but quickly cluttered as logic grows.

Modular implementations encapsulate Fibonacci generation in named functions, which improves clarity and documents intent.

Functions greatly increase reusability: the same routine can be imported and reused without duplication.

Debugging is easier with functions since units can be tested in isolation and traced independently.

For larger systems, modular design scales far better—it's maintainable, testable, and integrates cleanly into other components.

Task 5: AI-Generated Iterative vs Recursive Fibonacci Approaches (Different Algorithmic Approaches for Fibonacci Series)

- ❖ **Scenario :** Your mentor wants to assess AI's understanding of different algorithmic paradigms.

- **Prompt used :**

Iterative Prompt :

```
# Generate Fibonacci sequence using iterative approach.
```

Recursive Prompt

```
# Generate Fibonacci sequence using recursive approach.
```

- **Generated code :**

```
"""Iterative Fibonacci sequence generator.
```

```
This script reads an integer `n` from standard input and prints the first `n` Fibonacci numbers using an iterative loop (no recursion).
```

```
"""
```

```
try:  
    n = int(input("Enter the number of terms: "))  
except ValueError:  
    print("Please enter a valid integer")  
    raise SystemExit  
  
if n <= 0:  
    print("Please enter a positive integer")
```

```

else:
# Initialize the first two Fibonacci numbers
a, b = 0, 1
# Print the sequence iteratively, printing values on the fly
for i in range(n):
end = " " if i < n - 1 else "\n"
print(a, end=end)
a, b = b, a + b

```

"""Recursive Fibonacci sequence generator.

This script defines a recursive function `fib(k)` that returns the k-th Fibonacci number and then uses it to print the first `n` Fibonacci numbers.
Note: naive recursion has exponential time complexity; use small `n`.
"""

```

def fib(k):
"""Return the k-th Fibonacci number using recursion.

Base cases: fib(0) = 0, fib(1) = 1.
Recursive case: fib(k) = fib(k-1) + fib(k-2).
"""

if k <= 1:
return k
return fib(k - 1) + fib(k - 2)

try:
n = int(input("Enter the number of terms: "))
except ValueError:
print("Please enter a valid integer")
raise SystemExit

if n <= 0:
print("Please enter a positive integer")
else:
# Print the first n Fibonacci numbers using the recursive function
for i in range(n):
end = " " if i < n - 1 else "\n"
print(fib(i), end=end)

```

- **Sample Input :**

Enter the number of terms: 5

- **Sample Output :**

0 1 1 2 3

task1.py

```

1 try:
2     n = int(input("Enter the number of terms: "))
3 except ValueError:
4     print("Please enter a valid integer")
5     raise SystemExit
6
7 if n <= 0:
8     print("Please enter a positive integer")
9 else:
10    a, b = 0, 1
11    seq = []
12    for _ in range(n):
13        seq.append(str(a))
14        a, b = b, a + b
15    print("Fibonacci sequence up to {} terms:".format(n))
16    print(" ".join(seq))
17

```

PROBLEMS **OUTPUT** **DEBUG CONSOLE** **TERMINAL** **PORTS**

anumandlarithika@Mac lab1.3 % 5
anumandlarithika@Mac lab1.3 % /usr/bin/python3 /Users/anumandlarithika/SRU/AI_Assisted_lab/lab1.3/task1.py
Enter the number of terms: 5
Fibonacci sequence up to 5 terms:
0 1 1 2 3
anumandlarithika@Mac lab1.3 %

OUTLINE **TIMELINE**

task2.py

```

1 try:
2     n = int(input("Enter the number of terms: "))
3 except ValueError:
4     print("Please enter a valid integer")
5     raise SystemExit
6
7 if n <= 0:
8     print("Please enter a positive integer")
9 else:
10    prev, curr = 0, 1
11    print("Fibonacci sequence up to {} terms:".format(n))
12    for i in range(n):
13        end = " " if i < n - 1 else "\n"
14        print(prev, end=end)
15        prev, curr = curr, prev + curr

```

PROBLEMS **OUTPUT** **DEBUG CONSOLE** **TERMINAL** **PORTS**

anumandlarithika@Mac lab1.3 % 5
anumandlarithika@Mac lab1.3 % /usr/bin/python3 /Users/anumandlarithika/SRU/AI_Assisted_lab/lab1.3/task2.py
Enter the number of terms: 5
Fibonacci sequence up to 5 terms:
0 1 1 2 3
anumandlarithika@Mac lab1.3 % /usr/bin/python3 /Users/anumandlarithika/SRU/AI_Assisted_lab/lab1.3/task2.py
Enter the number of terms: 5
Fibonacci sequence up to 5 terms:
0 1 1 2 3
anumandlarithika@Mac lab1.3 % 10
zsh: command not found: 10
anumandlarithika@Mac lab1.3 %

OUTLINE **TIMELINE**

```

task3.py > ...
1 def fibonacci(n):
2     """Return the first n Fibonacci numbers as a list.
3
4     Args:
5         n (int): Number of terms to generate. If n <= 0, an empty list
6             is returned.
7
8     Returns:
9         list[int]: List of Fibonacci numbers of length n.
10
11
12     if n <= 0:
13         return []
14     if n == 1:
15         return [0]
16
17     seq = [0, 1]
18     while len(seq) < n:
19         seq.append(seq[-1] + seq[-2])
20
21     return seq
22
23
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46
if __name__ == "__main__":
    try:
        n = int(input("Enter the number of terms: "))
    except ValueError:
        print("Please enter a valid integer")
        raise SystemExit
    if n <= 0:
        print("Please enter a positive integer")
    else:
        # Generate and print the sequence on one line, space-separated
        seq = fibonacci(n)
        print("Fibonacci sequence up to {} terms:".format(n))
        print(" ".join(str(x) for x in seq))

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```

gnumandiarithika@Mac lab1.3 % /usr/bin/python3 /Users/anumandiarithika/GRU/AI_Assisted_Lab/lab1.3/task3.py
Enter the number of terms: 5
Fibonacci sequence up to 5 terms:
0 1 1 2 3
gnumandiarithika@Mac lab1.3 %

```

Comparison Table

Aspect	Procedural (no functions)	Modular (with functions)
Code clarity	Clear for very short, one-off scripts; inline logic becomes harder to follow as size grows.	High: named functions separate intent from implementation, making the main flow concise and readable.
Reusability	Low: logic is tied to the script and must be copied to reuse.	High: functions can be imported and reused across programs.
Ease of debugging	Lower: harder to isolate faults; debugging requires tracing the whole linear flow.	Higher: small units can be tested and debugged independently (unit tests, isolated tracing).
Suitability for larger systems (scalability)	Poor: difficult to maintain, extend, or integrate into larger codebases.	Excellent: supports modular design, testing, and easier maintenance in large systems.

The screenshot shows the VS Code interface with the following details:

- EXPLORER:** Shows files in the `LAB1.3` folder: `task1.py`, `task2.py`, `task3.py`, `task4.py`, `task5.py`, and `task6.py`.
- CODE EDITOR:** The `task6.py` file is open, containing a recursive Fibonacci sequence generator. The code uses a base case (`fib(0) = 0, fib(1) = 1`), a recursive case (`fib(k) = fib(k-1) + fib(k-2)`), and handles user input for the number of terms.
- TERMINAL:** Shows the command `echo 7 | /usr/bin/python3 /Users/anumandlarithika/SRU/AI_Assisted_lab/lab1.3/task6.py` being run, followed by the output: `Enter the number of terms: 7` and the resulting Fibonacci sequence: `0 1 1 2 3 5 8`.
- CHAT:** A GPT-4 chat window titled "FIBONACCI SEQUENCE PROGRAM IN PYTHON". It discusses the recursive approach, finalizing the implementation, creating a TODO entry for task6.py, and completing the recursive Fibonacci sequence.
- TODOS:** Shows 5 items in the todos list, all related to the Fibonacci sequence implementation.

The screenshot shows the VS Code interface with the following details:

- EXPLORER:** Shows files in the `LAB1.3` folder: `task1.py`, `task2.py`, `task3.py`, `task4.py`, and `task5.py`.
- CODE EDITOR:** The `task5.py` file is open, containing an iterative Fibonacci sequence generator. It initializes the first two numbers (`a, b = 0, 1`), prints the sequence iteratively, and handles user input for the number of terms.
- TERMINAL:** Shows the command `/usr/bin/python3 /Users/anumandlarithika/SRU/AI_Assisted_lab/lab1.3/task5.py` being run, followed by the output: `Enter the number of terms: 5` and the resulting Fibonacci sequence: `0 1 1 2 3`.
- CHAT:** A GPT-4 chat window titled "FIBONACCI SEQUENCE PROGRAM IN PYTHON". It discusses the iterative approach, crafting the iterative Fibonacci sequence code, adding a TODO entry for task5.py, and managing todo items for planning.
- TODOS:** Shows 4 items in the todos list, all related to the iterative Fibonacci sequence implementation.