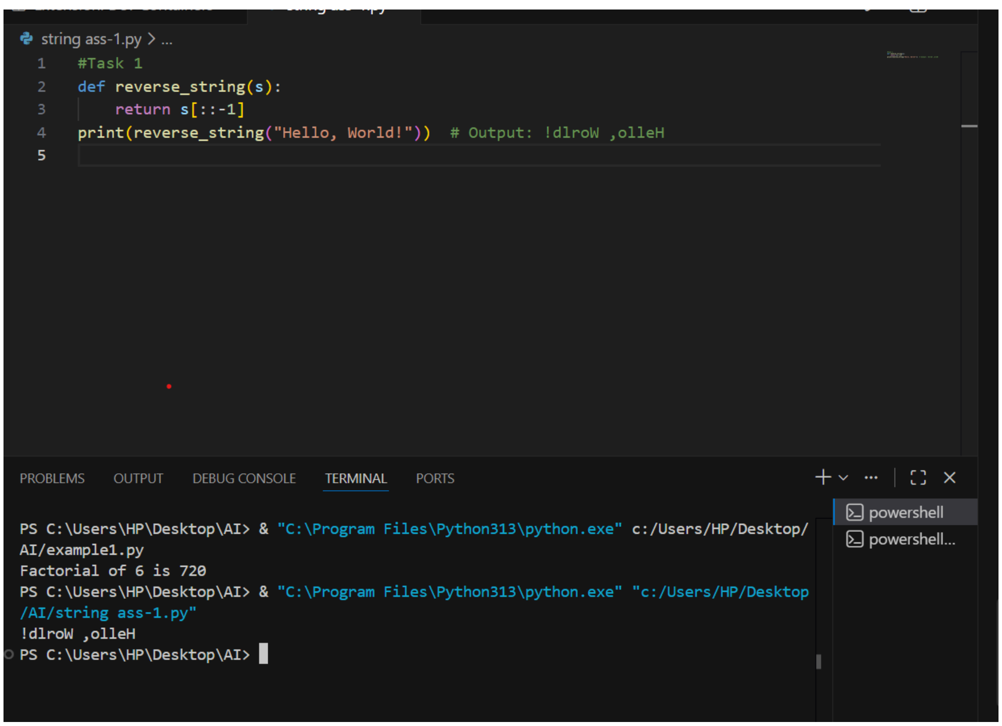
AI ASSISTED CODING ASSIGNMENT-1

RUDROJU RUPA SRI

2303A51918

Task 1: AI-Generated Logic Without Modularization (String Reversal Without Functions)
❖ Scenario
You are developing a basic text-processing utility for a messaging application.
❖ Task Description
Use GitHub Copilot to generate a Python program that:
➢ Reverses a given string
➢ Accepts user input
➢ Implements the logic directly in the main code
➢ Does not use any user-defined functions
❖ Expected Output
➢ Correct reversed string
➢ Screenshots showing Copilot-generated code suggestions
➢ Sample inputs and outputs

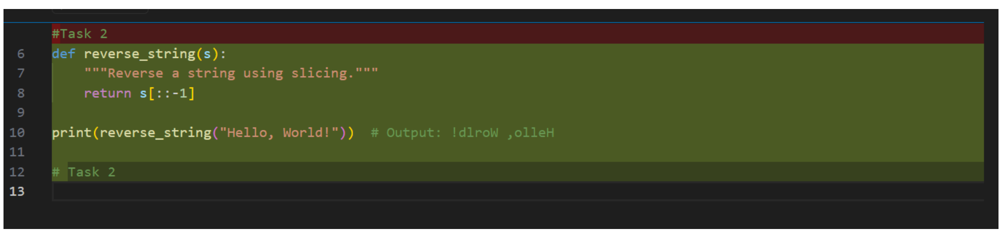


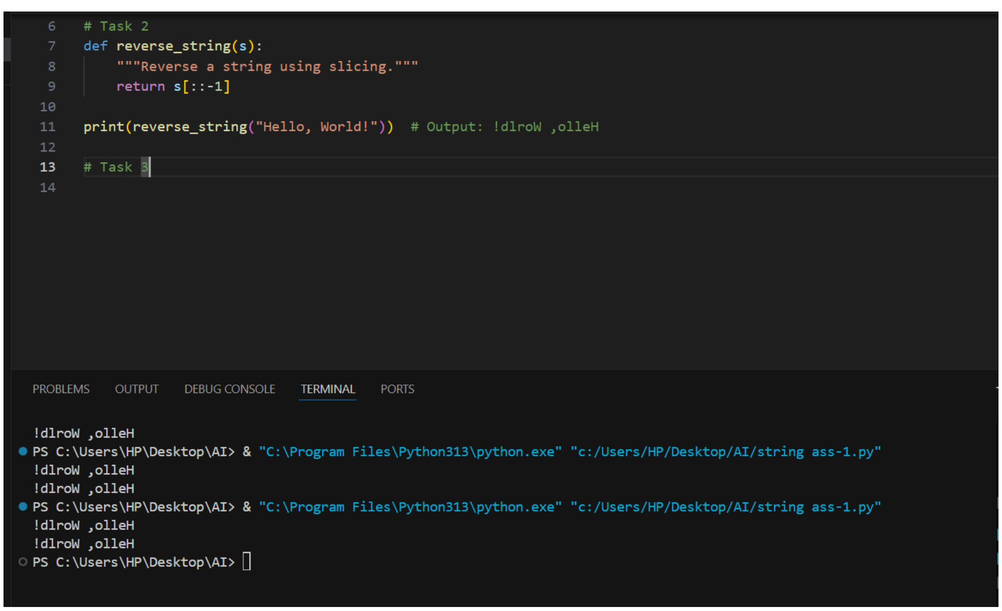

```
#Task 1
def reverse_string(s):
    return s[::-1]
print(reverse_string("Hello, World!"))  # Output: !dlroW ,olleH
```

- This code defines a function named **reverse_string**.

- The function takes a string as input.
- It uses slicing **[::-1]** to reverse the string.
- The reversed string is returned by the function.
- Finally, the program prints the reversed output: **!dlroW ,olleH**.

Task 2: Efficiency & Logic Optimization (Readability Improvement)
❖ Scenario
The code will be reviewed by other developers.
❖ Task Description
Examine the Copilot-generated code from Task 1 and improve it by:
➢ Removing unnecessary variables
➢ Simplifying loop or indexing logic
➢ Improving readability
➢ Use Copilot prompts like:
▪ "Simplify this string reversal code"
▪ "Improve readability and efficiency"
Hint:
Prompt Copilot with phrases like
"optimize this code", "simplify logic", or "make it more readable"
❖ Expected Output
➢ Original and optimized code versions
➢ Explanation of how the improvements reduce time complexity

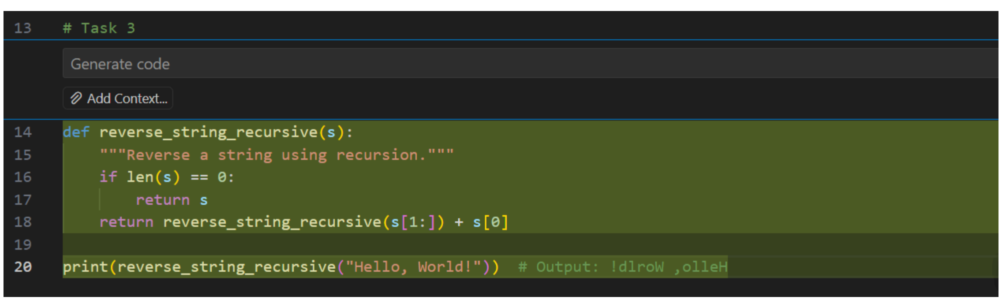


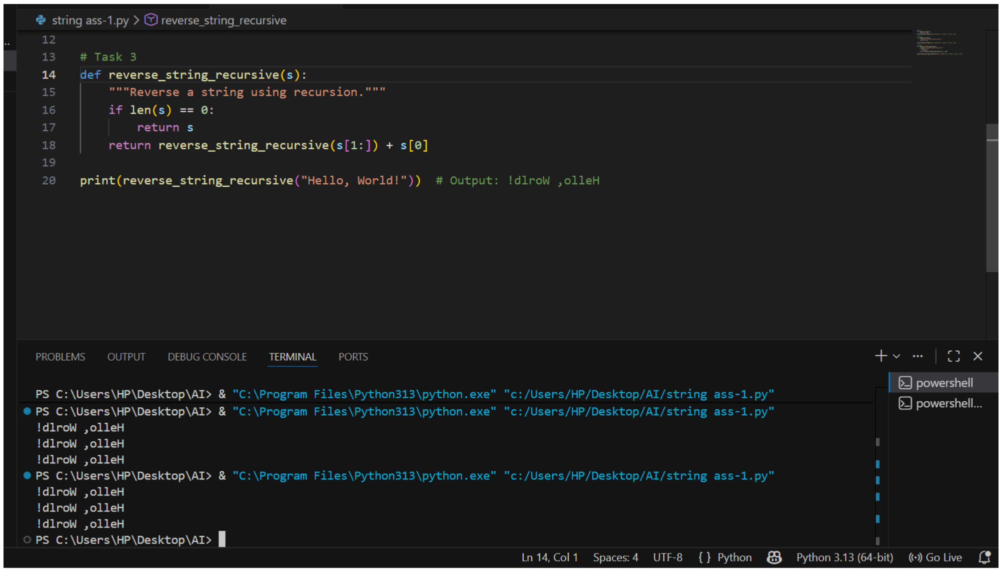


```
# Task 2
def reverse_string(s):
    """Reverse a string using slicing."""
    return s[::-1]

print(reverse_string("Hello, World!"))  # Output: !dlroW ,olleH
```

1. The code defines a function named **reverse_string**.
2. It takes one parameter **s**, which is a string.
3. The line `s[::-1]` reverses the string using Python slicing.
4. The function returns the reversed string as output.
5. The print statement calls the function and displays **!dlroW ,olleH**.

Task 3: Modular Design Using AI Assistance (String Reversal Using Functions)
❖ Scenario
The string reversal logic is needed in multiple parts of an application.
❖ Task Description
Use GitHub Copilot to generate a function-based Python program that:
➢ Uses a user-defined function to reverse a string
➢ Returns the reversed string
➢ Includes meaningful comments (AI-assisted)
❖ Expected Output
➢ Correct function-based implementation
➢ Screenshots documenting Copilot's function generation
➢ Sample test cases and outputs






```
# Task 3
def reverse_string_recursive(s):
    """Reverse a string using recursion."""
    if len(s) == 0:
        return s
    return reverse_string_recursive(s[1:]) + s[0]

print(reverse_string_recursive("Hello, World!"))  # Output: !dlroW ,olleH
```

- This code defines a function called **reverse_string_recursive**.
- It uses **recursion** to reverse the string.
- If the string is empty, it returns the string (base case).
- The function calls itself with the remaining string and adds the first character at the end.
- The final output printed is **!dlroW ,olleH**.
- This code compares execution time of reversing a string **with and without a function**.
- First, the string is reversed directly using slicing inside a loop.
- Then, the same string is reversed using a **recursive function**.
- The `time` module measures how long each method takes.
- The results show that recursion is **slower than direct slicing**.

Task 4: Comparative Analysis – Procedural vs Modular Approach (With vs Without Functions)

❖ Scenario

You are asked to justify design choices during a code review.

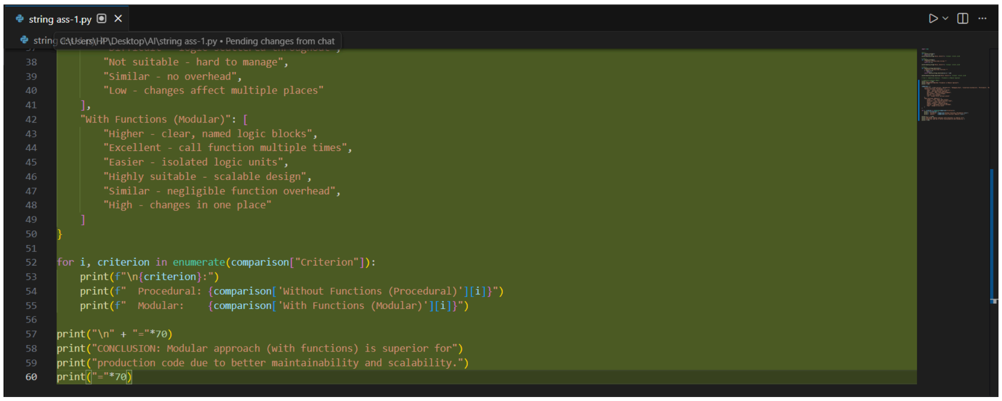
❖ Task Description

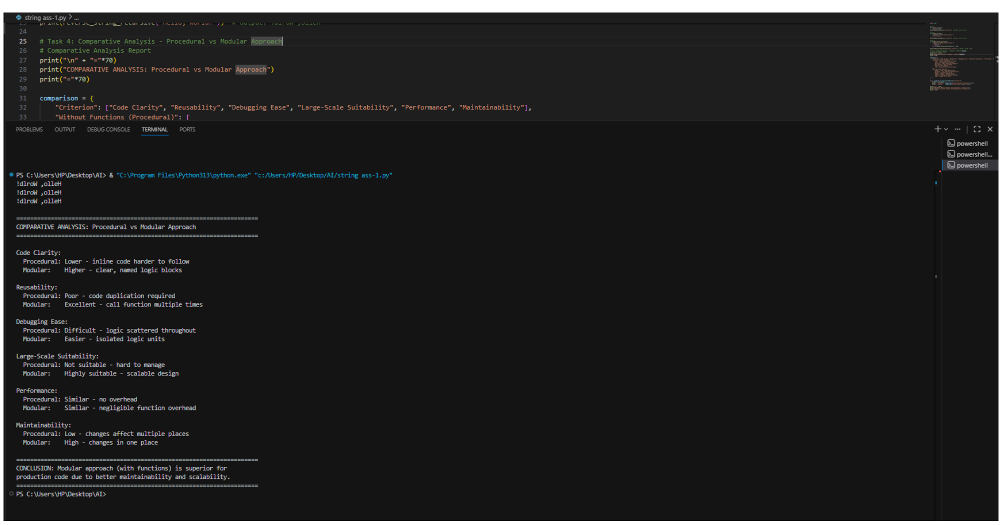
Compare the Copilot-generated programs:

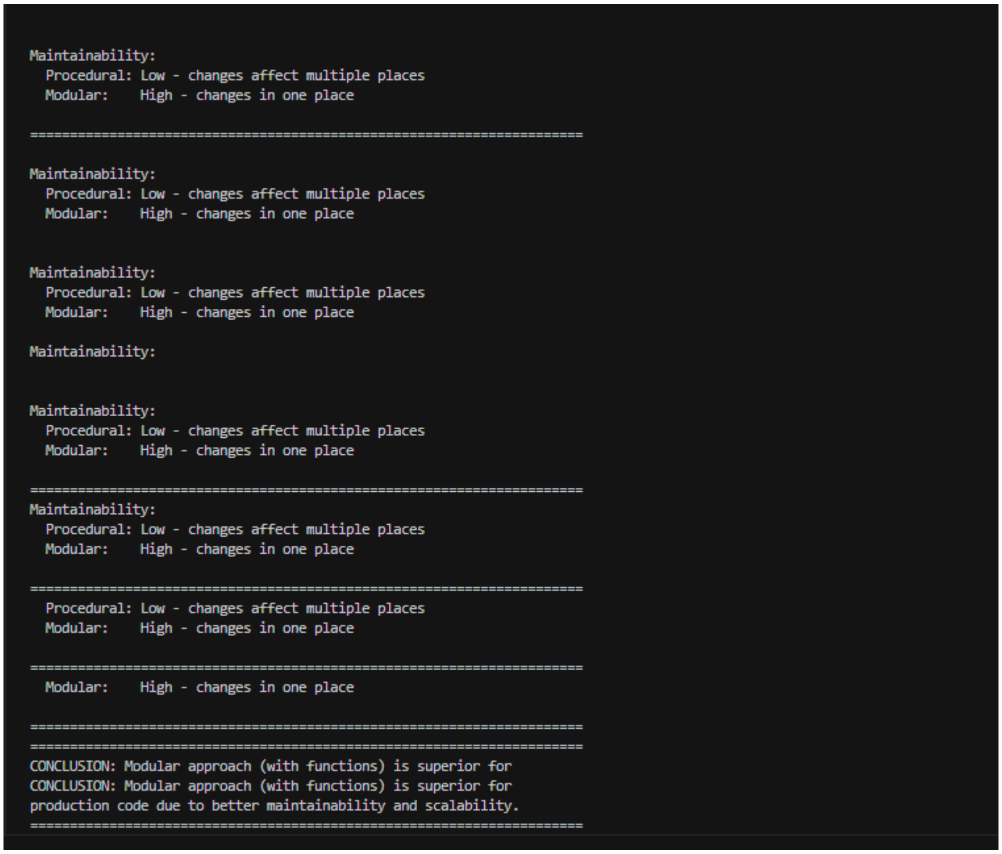
➢ Without functions (Task 1)

➢ With functions (Task 3)

Analyze them based on:
➢ Code clarity
➢ Reusability
➢ Debugging ease
➢ Suitability for large-scale applications
❖ Expected Output
Comparison table or short analytical report







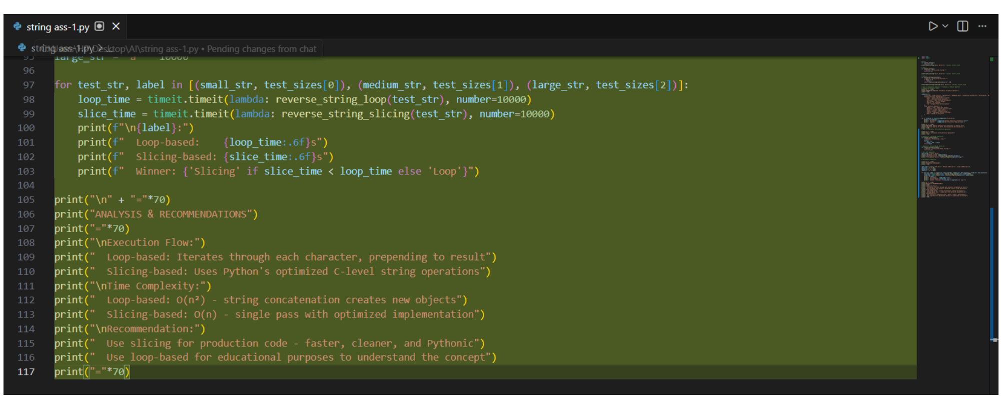
```
Maintainability:
  Procedural: Low - changes affect multiple places
  Modular:    High - changes in one place

======================================================================

Maintainability:
  Procedural: Low - changes affect multiple places
  Modular:    High - changes in one place


Maintainability:
  Procedural: Low - changes affect multiple places
  Modular:    High - changes in one place

Maintainability:


Maintainability:
  Procedural: Low - changes affect multiple places
  Modular:    High - changes in one place

======================================================================
Maintainability:
  Procedural: Low - changes affect multiple places
  Modular:    High - changes in one place

======================================================================
  Procedural: Low - changes affect multiple places
  Modular:    High - changes in one place

======================================================================
  Modular:    High - changes in one place

======================================================================
======================================================================
CONCLUSION: Modular approach (with functions) is superior for
CONCLUSION: Modular approach (with functions) is superior for
production code due to better maintainability and scalability.
======================================================================
```

```
# Task 4: Comparative Analysis - Procedural vs Modular Approach
# Comparative Analysis Report
print("\n" + "="*70)
print("COMPARATIVE ANALYSIS: Procedural vs Modular Approach")
print("="*70)

comparison = {
    "Criterion": ["Code Clarity", "Reusability", "Debugging Ease", "Large-Scale Suitabili
ty", "Performance", "Maintainability"],
    "Without Functions (Procedural)": [
        "Lower - inline code harder to follow",
        "Poor - code duplication required",
        "Difficult - logic scattered throughout",
        "Not suitable - hard to manage",
        "Similar - no overhead",
        "Low - changes affect multiple places"
    ],
    "With Functions (Modular)": [
        "Higher - clear, named logic blocks",
        "Excellent - call function multiple times",
        "Easier - isolated logic units",
        "Highly suitable - scalable design",
        "Similar - negligible function overhead",
        "High - changes in one place"
```

```
    ]
}

for i, criterion in enumerate(comparison["Criterion"]):
    print(f"\n{criterion}:")
    print(f"  Procedural: {comparison['Without Functions (Procedural)'][i]}")
    print(f"  Modular:    {comparison['With Functions (Modular)'][i]}")

print("\n" + "="*70)
print("CONCLUSION: Modular approach (with functions) is superior for")
print("production code due to better maintainability and scalability.")
print("="*70)
```

- This code compares **procedural (without functions)** and **modular (with functions)** programming.
- A dictionary stores comparison points like clarity, reusability, debugging, and performance.
- The program prints each criterion and shows both approaches side by side.
- It highlights that modular code is easier to manage, debug, and reuse.
- The conclusion states that **using functions is better for large and real-world projects**

Task 5: AI-Generated Iterative vs Recursive Fibonacci Approaches (Different
Algorithmic Approaches to String Reversal)
❖ Scenario
Your mentor wants to evaluate how AI handles alternative logic paths.
❖ Task Description
Prompt GitHub Copilot to generate:
➢ A loop-based string reversal approach
➢ A built-in / slicing-based string reversal approach
❖ Expected Output
➢ Two correct implementations
➢ Comparison discussing:
▪ Execution flow
▪ Time complexity
▪ Performance for large inputs
▪ When each approach is appropriate

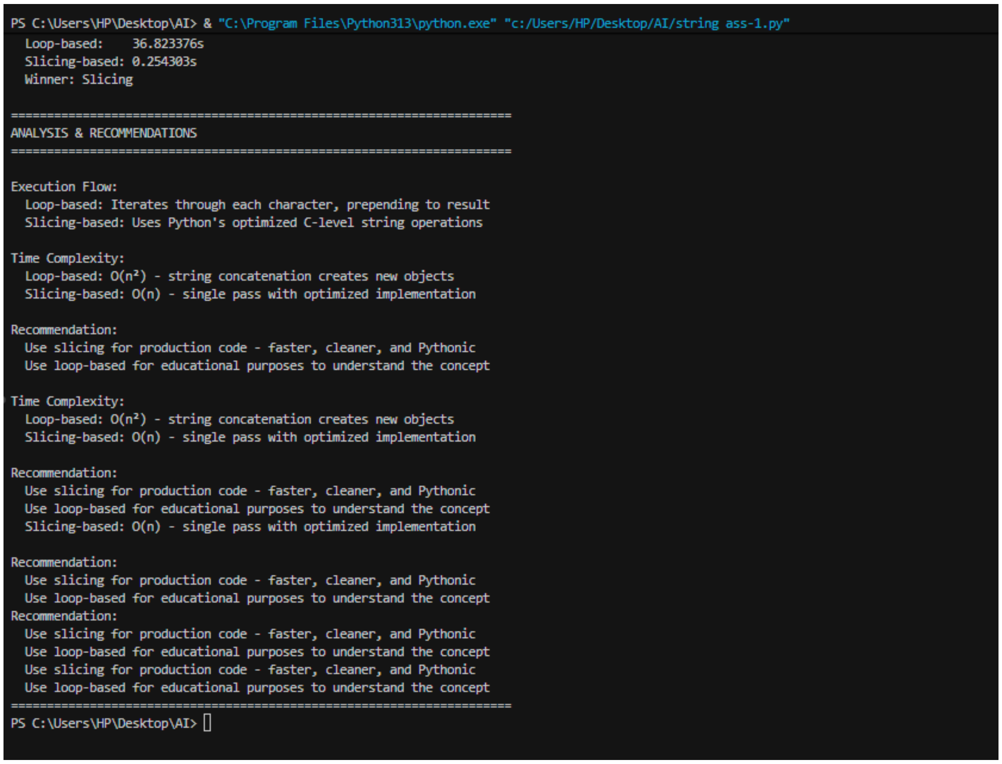


string ass-1.py

```python
# Task 5: Alternative String Reversal Approaches

print("\n" + "="*70)
print("TASK 5: Alternative String Reversal Approaches")
print("="*70)

# Approach 1: Loop-based (Iterative)
def reverse_string_loop(s):
    """Reverse a string using a loop."""
    result = ""
    for char in s:
        result = char + result
    return result

# Approach 2: Slicing-based (Built-in)
def reverse_string_slicing(s):
    """Reverse a string using Python slicing."""
    return s[::-1]

# Test both approaches
test_string = "Hello, World!"
print(f"\nOriginal string: {test_string}")
print(f"Loop-based result: {reverse_string_loop(test_string)}")
print(f"Slicing-based result: {reverse_string_slicing(test_string)}")

# Performance comparison

print("\n" + "="*70)
print("PERFORMANCE COMPARISON")
print("="*70)

test_sizes = ["Small (100 chars)", "Medium (1000 chars)", "Large (10000 chars)"]
small_str = "a" * 100
medium_str = "a" * 1000
large_str = "a" * 10000

for test_str, label in [(small_str, test_sizes[0]), (medium_str, test_sizes[1]), (large_str, test_sizes[2])]:
    loop_time = timeit.timeit(lambda: reverse_string_loop(test_str), number=10000)
    slice_time = timeit.timeit(lambda: reverse_string_slicing(test_str), number=10000)
    print(f"\n{label}:")
    print(f"  Loop-based:    {loop_time:.6f}s")
    print(f"  Slicing-based: {slice_time:.6f}s")
    print(f"  Winner: {'Slicing' if slice_time < loop_time else 'Loop'}")

print("\n" + "="*70)
print("ANALYSIS & RECOMMENDATIONS")
print("="*70)
print("\nExecution Flow:")
print("  Loop-based: Iterates through each character, prepending to result")
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
PS C:\Users\HP\Desktop\AI> & "C:\Program Files\Python313\python.exe" "c:/Users/HP/Desktop/AI/string ass-1.py"

======================================================================
TASK 5: Alternative String Reversal Approaches
======================================================================

Original string: Hello, World!
Loop-based result: !dlroW ,olleH
Slicing-based result: !dlroW ,olleH

======================================================================
PERFORMANCE COMPARISON
======================================================================

Small (100 chars):
  Loop-based:    0.223679s
  Slicing-based: 0.003623s
  Winner: Slicing

Medium (1000 chars):
  Loop-based:    2.409064s
  Slicing-based: 0.047626s
  Winner: Slicing

Large (10000 chars):
  Loop-based:    36.823376s
  Slicing-based: 0.254303s
  Winner: Slicing

======================================================================
ANALYSIS & RECOMMENDATIONS
======================================================================

Execution Flow:
  Loop-based: Iterates through each character, prepending to result
  Slicing-based: Uses Python's optimized C-level string operations

Time Complexity:
  Loop-based: O(n²) - string concatenation creates new objects
  Slicing-based: O(n) - single pass with optimized implementation

Recommendation:
  Use slicing for production code - faster, cleaner, and Pythonic
  Use loop-based for educational purposes to understand the concept

Time Complexity:
  Loop-based: O(n²) - string concatenation creates new objects
  Slicing-based: O(n) - single pass with optimized implementation

Recommendation:
  Use slicing for production code - faster, cleaner, and Pythonic
```


```
PS C:\Users\HP\Desktop\AI> & "C:\Program Files\Python313\python.exe" "c:/Users/HP/Desktop/AI/string ass-1.py"
  Loop-based:    36.823376s
  Slicing-based: 0.254303s
  Winner: Slicing

======================================================================
ANALYSIS & RECOMMENDATIONS
======================================================================

Execution Flow:
  Loop-based: Iterates through each character, prepending to result
  Slicing-based: Uses Python's optimized C-level string operations

Time Complexity:
  Loop-based: O(n²) - string concatenation creates new objects
  Slicing-based: O(n) - single pass with optimized implementation

Recommendation:
  Use slicing for production code - faster, cleaner, and Pythonic
  Use loop-based for educational purposes to understand the concept

Time Complexity:
  Loop-based: O(n²) - string concatenation creates new objects
  Slicing-based: O(n) - single pass with optimized implementation

Recommendation:
  Use slicing for production code - faster, cleaner, and Pythonic
  Use loop-based for educational purposes to understand the concept
  Slicing-based: O(n) - single pass with optimized implementation

Recommendation:
  Use slicing for production code - faster, cleaner, and Pythonic
  Use loop-based for educational purposes to understand the concept
Recommendation:
  Use slicing for production code - faster, cleaner, and Pythonic
  Use loop-based for educational purposes to understand the concept
  Use slicing for production code - faster, cleaner, and Pythonic
  Use loop-based for educational purposes to understand the concept
======================================================================
PS C:\Users\HP\Desktop\AI>
```

```python
# Task 5: Alternative String Reversal Approaches

print("\n" + "="*70)
print("TASK 5: Alternative String Reversal Approaches")
print("="*70)

# Approach 1: Loop-based (Iterative)
def reverse_string_loop(s):
    """Reverse a string using a loop."""
    result = ""
    for char in s:
        result = char + result
    return result

# Approach 2: Slicing-based (Built-in)
def reverse_string_slicing(s):
    """Reverse a string using Python slicing."""
    return s[::-1]

# Test both approaches
test_string = "Hello, World!"
print(f"\nOriginal string: {test_string}")
print(f"Loop-based result: {reverse_string_loop(test_string)}")
print(f"Slicing-based result: {reverse_string_slicing(test_string)}")

# Performance comparison
```

```
print("\n" + "="*70)
print("PERFORMANCE COMPARISON")
print("="*70)

test_sizes = ["Small (100 chars)", "Medium (1000 chars)", "Large (10000 chars)"]
small_str = "a" * 100
medium_str = "a" * 1000
large_str = "a" * 10000

for test_str, label in [(small_str, test_sizes[0]), (medium_str, test_sizes[1]), (large_s
tr, test_sizes[2])]:
    loop_time = timeit.timeit(lambda: reverse_string_loop(test_str), number=10000)
    slice_time = timeit.timeit(lambda: reverse_string_slicing(test_str), number=10000)
    print(f"\n{label}:")
    print(f"  Loop-based:    {loop_time:.6f}s")
    print(f"  Slicing-based: {slice_time:.6f}s")
    print(f"  Winner: {'Slicing' if slice_time < loop_time else 'Loop'}")

print("\n" + "="*70)
print("ANALYSIS & RECOMMENDATIONS")
print("="*70)
print("\nExecution Flow:")
print("  Loop-based: Iterates through each character, prepending to result")
print("  Slicing-based: Uses Python's optimized C-level string operations")
print("\nTime Complexity:")
print("  Loop-based: O(n²) - string concatenation creates new objects")
print("  Slicing-based: O(n) - single pass with optimized implementation")
print("\nRecommendation:")
print("  Use slicing for production code - faster, cleaner, and Pythonic")
print("  Use loop-based for educational purposes to understand the concept")
print("="*70)
```

Execution Complexity

- **Loop-based approach: $O(n^2)$** because strings are immutable and each concatenation creates a new string.
- **Slicing-based approach: $O(n)$** because Python reverses the string in one optimized operation.

🔹 When to Use Each Approach

- **Loop-based reversal:** Use for **learning and understanding logic**, not for large data.
- **Slicing-based reversal:** Use in **real-world and production code** for speed and simplicity.

🔹 Performance Comparison

- **Loop-based:** Slower, especially for long strings.
- **Slicing-based:** Much faster and more memory-efficient.

🔹 Overall Comparison

Feature	Loop-Based	Slicing-Based
Time Complexity	$O(n^2)$	$O(n)$
Speed	Slow	Fast
Code Length	Longer	Very short
Best Use	Learning	Production