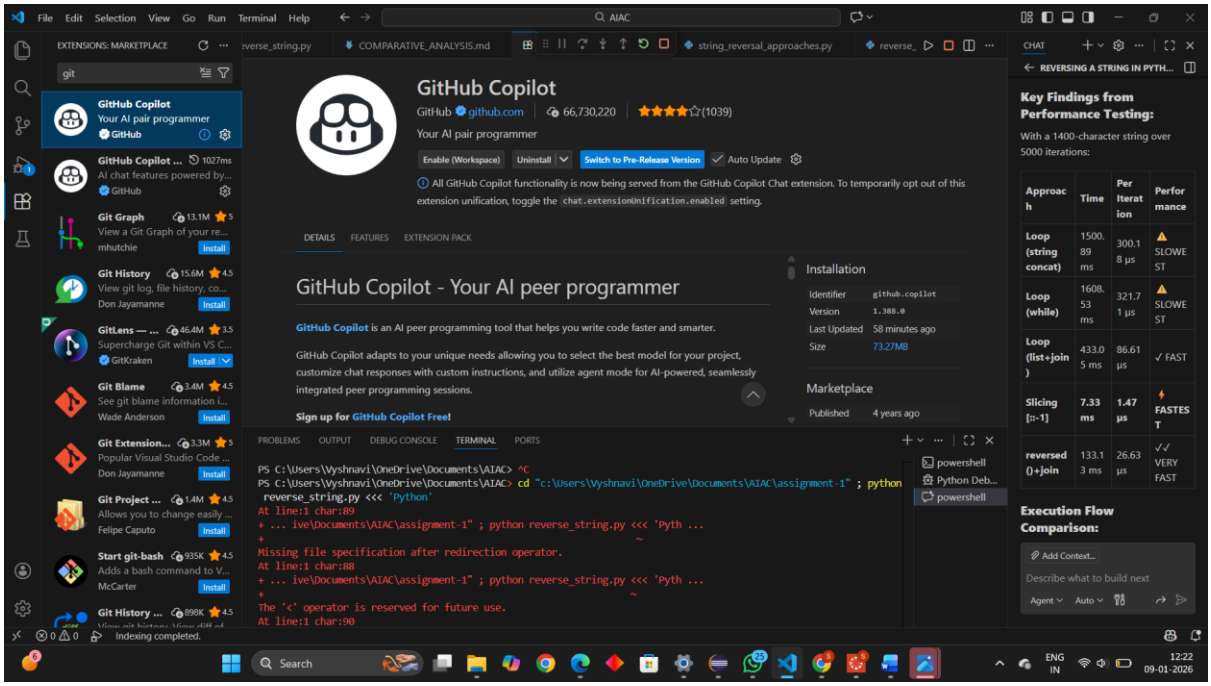
AI Assisted Coding-

ASSIGNMENT 1.5

ROLL NO:2303A52196

Batch-35



Lab 1: Environment Setup – GitHub Copilot and VS Code Integration +

Understanding AI-assisted Coding Workflow

Lab Objectives:

❖ To install and configure GitHub Copilot in Visual Studio Code.

Week1 -

Monday

❖ To explore AI-assisted code generation using GitHub Copilot.

❖ To analyze the accuracy and effectiveness of Copilot's code suggestions.

❖ To understand prompt-based programming using comments and code

context

Lab Outcomes (LOs):

After completing this lab, students will be able to:

❖ Set up GitHub Copilot in VS Code successfully.

❖ Use inline comments and context to generate code with Copilot.

❖ Evaluate AI-generated code for correctness and readability.

❖ Compare code suggestions based on different prompts and programming styles.

Task 0

❖ Install and configure GitHub Copilot in VS Code. Take screenshots of each step.

Expected Output

❖ Install and configure GitHub Copilot in VS Code. Take screenshots of each step.

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 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 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 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

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

solution

```
def reverse_string(text):
    """
    Reverses the given string using Python's slicing method.
```

```
    Args:
        text (str): The string to be reversed

    Returns:
        str: The reversed string

    Time Complexity: O(n) where n is the length of the string
    Space Complexity: O(n) for the new reversed string
    """
    return text[::-1]

def main():
    """
    Main function that accepts user input and displays the reversed string.
    """
    # Accept user input
    user_input = input('Enter a string to reverse: ')

    # Call the reverse function
    result = reverse_string(user_input)

    # Display the result
    print(f'Original string: {user_input}')
    print(f'Reversed string: {result}')

# Sample test cases
if __name__ == '__main__':
    print('=== String Reversal Program ===\n')

    # Test Case 1: Basic string
    print('Test Case 1 - Basic String:')
```

```
test1 = 'Hello'
print(f'Input: {test1}')
print(f'Output: {reverse_string(test1)}\n')

# Test Case 2: String with spaces
print('Test Case 2 - String with Spaces:')
test2 = 'Hello, World!'
print(f'Input: {test2}')
print(f'Output: {reverse_string(test2)}\n')

# Test Case 3: Palindrome
print('Test Case 3 - Palindrome:')
test3 = 'racecar'
print(f'Input: {test3}')
print(f'Output: {reverse_string(test3)}\n')

# Test Case 4: Empty string
print('Test Case 4 - Empty String:')
test4 = ''
print(f'Input: "{test4}"')
print(f'Output: "{reverse_string(test4)}"\n')

# Test Case 5: Single character
print('Test Case 5 - Single Character:')
test5 = 'A'
print(f'Input: {test5}')
print(f'Output: {reverse_string(test5)}\n')

# Interactive mode
print('=== Interactive Mode ===')
main()
```

Comparative Analysis: Procedural vs Modular Approach

Overview

This document compares two approaches to string reversal in Python:

- **Task 1 (Procedural)**: Direct implementation without user-defined functions

- **Task 3 (Modular)**: Function-based implementation with reusability

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Side-by-Side Code Comparison

Task 1: Procedural Approach (Without Functions)

```python
print('Reversed string:', input('Enter a string to reverse: ')[::-1])
```

Task 3: Modular Approach (With Functions)

```python
def reverse_string(text):
    """Reverses the given string using Python's slicing method."""
    return text[::-1]

def main():
    """Main function that accepts user input and displays the reversed string."""
    user_input = input('Enter a string to reverse: ')
    result = reverse_string(user_input)
    print(f'Original string: {user_input}')
    print(f'Reversed string: {result}')
```

```
if __name__ == '__main__':
    main()
```

Detailed Comparison Table

Criteria	Procedural (Task 1)	Modular (Task 3)	Winner
Code Clarity	✓ Very concise (1 line)	✓✓ Clear structure with docstrings	**Modular**
Readability	✓ Simple but cryptic	✓✓ Self-documenting with docstrings	**Modular**
Reusability	✗ Hard to reuse	✓✓ Can import and use anywhere	**Modular**
Testability	✗ Not easy to unit test	✓✓ Functions can be easily tested	**Modular**
Debugging	✗ Difficult to debug	✓✓ Easy to trace and debug	**Modular**
Maintenance	✗ Hard to modify	✓✓ Changes isolated to function	**Modular**
Scalability	✗ Not suitable for large projects	✓✓ Ideal for enterprise applications	**Modular**
Documentation	✗ No docstrings	✓✓ Comprehensive docstrings	**Modular**
Error Handling	✗ None	✓ Can be extended	**Modular**
Lines of Code	1	15+	**Procedural**

Detailed Analysis

1. Code Clarity

Procedural Approach:

- Extremely concise but requires deep understanding of Python slicing
- No comments explaining the logic
- Chain operations in one line makes it harder for beginners to follow

Modular Approach:

- Clear separation of concerns

- Each function has a specific purpose

- Docstrings explain parameters, returns, and complexity

- **Winner: Modular** ✓

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2. Reusability

Procedural Approach:

- Logic is embedded in the main code

- Requires code duplication if reversal is needed elsewhere

- No way to reuse without copy-paste

Modular Approach:

```python
from reverse_string import reverse_string

# Can be used anywhere
result = reverse_string("Hello")
```

- Single source of truth

- Can be imported in other modules

- **Winner: Modular** ✓✓

---

3. Debugging Ease

Procedural Approach:

- No breakpoints to isolate issues

- Entire operation happens in one line

- Hard to track where an error occurs

Modular Approach:

- Can set breakpoints inside `reverse_string()` function

- Can test each component independently

- Stack traces are more informative

- **Winner: Modular** ✓✓

---

4. Testability

Procedural Approach:

```python
# Difficult to unit test
# Would need to test the entire input/output flow
```

Modular Approach:

```python
import unittest

class TestReverseString(unittest.TestCase):
    def test_basic(self):
        self.assertEqual(reverse_string("Hello"), "olleH")

    def test_empty(self):
        self.assertEqual(reverse_string(""), "")

    def test_palindrome(self):
        self.assertEqual(reverse_string("racecar"), "racecar")
```

```

- **Winner: Modular** ✓✓

---

### 5. Suitability for Large-Scale Applications

**Procedural Approach:**

- ✗ Not suitable
- No separation of concerns
- Difficult to maintain
- Hard to collaborate on large projects
- No clear interfaces

**Modular Approach:**

- ✓✓ Ideal for enterprise applications
- Clear function contracts (input/output)
- Easy to version control
- Simple to integrate with other modules
- Teams can work independently
- **Winner: Modular** ✓✓

---

### 6. Performance Considerations

Both approaches have identical performance:

- **Time Complexity**: O(n) - where n is the string length
- **Space Complexity**: O(n) - new reversed string created
- **Runtime**: Negligible difference

---
```

7. Maintenance & Evolution

Procedural Approach:

If we need to add error handling later:

```python
# Hard to extend without changing main code
```

Modular Approach:

```python
def reverse_string(text):
    """Reverses the given string."""
    if not isinstance(text, str):
        raise TypeError("Input must be a string")
    return text[::-1]

# Main code remains unchanged
```

- **Winner: Modular** ✓✓

Recommendations by Use Case

Use Case	Recommended Approach	Reason
Quick one-off script	Procedural	Simplicity
Production application	Modular	Maintainability
Team project	Modular	Collaboration
Large codebase	Modular	Scalability
Unit testing	Modular	Testability
Code review	Modular	Clarity

| **Future maintenance | Modular | Debugging |**

Conclusion

When to Use Procedural (Task 1):

✓ Quick prototyping

✓ Single-use scripts

✓ Learning Python basics

When to Use Modular (Task 3):

✓✓ Production code

✓✓ Team projects

✓✓ Large applications

✓✓ Code that needs testing

✓✓ Code that will be maintained/modified

Final Verdict

****The Modular Approach (Task 3) is the clear winner for professional software development.****

While the Procedural Approach is more concise, the Modular Approach provides:

- Better code organization

- Easier maintenance

- Better debugging capabilities

- Superior reusability

- Professional standards compliance

- Enterprise-ready structure

For small scripts, conciseness may matter. For real-world applications, modularity is essential.

Key Takeaway

> **"Write code not just for the computer, but for future developers (including your future self) who will maintain it."**

The modular approach follows this principle by prioritizing clarity, reusability, and maintainability over brevity.

STRING REVERSAL APPROACH

String Reversal: Iterative vs Built-in/Slicing Approaches

Demonstrates different algorithmic approaches to solve the same problem.

"""

```
# ============================================================================
# APPROACH 1: LOOP-BASED (ITERATIVE) STRING REVERSAL
# ============================================================================

def reverse_string_iterative(text):
    """
    Reverses a string using an explicit loop (iteration).

    Algorithm:
    - Initialize an empty result string
    - Iterate through the string from end to beginning (reverse order)
    - Append each character to the result

    Args:
        text (str): The string to be reversed
```

```
    Returns:
        str: The reversed string

    Time Complexity: O(n) where n is the length of the string
    Space Complexity: O(n) for the new result string

    Advantages:
    - Explicit control over iteration
    - Easy to understand for beginners
    - Can add custom logic during iteration
    - Compatible with older Python versions

    Disadvantages:
    - More verbose code
    - Slower than built-in slicing
    - String concatenation can be inefficient
    """
    result = ""
    for i in range(len(text) - 1, -1, -1):
        result += text[i]
    return result

# Alternative: Using a while loop
def reverse_string_iterative_while(text):
    """
    Reverses a string using a while loop.

    Args:
        text (str): The string to be reversed

    Returns:
```

```
    str: The reversed string
    """
    result = ""
    index = len(text) - 1
    while index >= 0:
        result += text[index]
        index -= 1
    return result

# Alternative: Using list and join (more efficient)
def reverse_string_iterative_optimized(text):
    """
    Reverses a string using a loop with list.append (more efficient).

    Args:
        text (str): The string to be reversed

    Returns:
        str: The reversed string

    Time Complexity: O(n)
    Space Complexity: O(n)

    Why more efficient?
    - Appending to list is O(1) amortized
    - String concatenation with += is O(n) each time
    - join() is O(n) for final conversion
    """
    result = []
    for i in range(len(text) - 1, -1, -1):
        result.append(text[i])
```

```
    return "".join(result)

# ============================================================================
# APPROACH 2: BUILT-IN SLICING (PYTHONIC) STRING REVERSAL
# ============================================================================

def reverse_string_slicing(text):
    """
    Reverses a string using Python's built-in slicing notation.

    Algorithm:
    - Use slice notation text[::-1]
    - -1 step means iterate backwards through entire string

    Args:
        text (str): The string to be reversed

    Returns:
        str: The reversed string

    Time Complexity: O(n) where n is the length of the string
    Space Complexity: O(n) for the new reversed string

    Advantages:
    - Most concise and readable
    - Optimized at C level in CPython
    - Fastest approach
    - Pythonic and idiomatic
    - No manual indexing errors

    Disadvantages:
```

```
    - Less explicit about what's happening
    - Can't easily add custom logic during reversal
    - May be unfamiliar to beginners
    """
    return text[::-1]

# ============================================================================
# APPROACH 3: USING REVERSED() BUILT-IN FUNCTION
# ============================================================================

def reverse_string_reversed_function(text):
    """
    Reverses a string using Python's reversed() built-in function.

    Args:
        text (str): The string to be reversed

    Returns:
        str: The reversed string
    """
    return "".join(reversed(text))

# ============================================================================
# PERFORMANCE TESTING AND DEMONSTRATION
# ============================================================================

import time

def test_all_approaches(test_string):
    """Tests all string reversal approaches and displays results."""
```

```
    print("=" * 70)
    print("STRING REVERSAL APPROACHES - DEMONSTRATION")
    print("=" * 70)
    print(f"\nTest String: '{test_string}'")
    print(f"String Length: {len(test_string)} characters\n")

    # Test each approach
    approaches = [
        ("1. Loop-based (for loop + concatenation)", reverse_string_iterative),
        ("2. Loop-based (while loop)", reverse_string_iterative_while),
        ("3. Loop-based (list + join - optimized)", reverse_string_iterative_optimized),
        ("4. Built-in slicing (Pythonic)", reverse_string_slicing),
        ("5. reversed() function + join", reverse_string_reversed_function),
    ]

    results = []
    for approach_name, func in approaches:
        result = func(test_string)
        results.append((approach_name, result))
        print(f"{approach_name}")
        print(f"  Result: '{result}'")
        print(f"  Correct: {result == test_string[::-1]}")
        print()

    return results

def performance_comparison(test_string, iterations=10000):
    """Compares performance of different approaches."""

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

```
print("=" * 70)
print(f"String Length: {len(test_string)} characters")
print(f"Iterations: {iterations}\n")

approaches = [
    ("1. Loop-based (for + concatenation)", reverse_string_iterative),
    ("2. Loop-based (while loop)", reverse_string_iterative_while),
    ("3. Loop-based (list + join)", reverse_string_iterative_optimized),
    ("4. Built-in slicing", reverse_string_slicing),
    ("5. reversed() + join", reverse_string_reversed_function),
]

times = []
for approach_name, func in approaches:
    start_time = time.perf_counter()
    for _ in range(iterations):
        func(test_string)
    end_time = time.perf_counter()

    elapsed_ms = (end_time - start_time) * 1000
    times.append((approach_name, elapsed_ms))
    print(f"{approach_name}")
    print(f"  Time: {elapsed_ms:.4f} ms")
    print(f"  Per iteration: {elapsed_ms/iterations*1000:.4f} µs")
    print()

# Find fastest
fastest = min(times, key=lambda x: x[1])
print(f"Fastest Approach: {fastest[0]} ({fastest[1]:.4f} ms)")
print()
```

```
    return times

# ============================================================================
# COMPARISON AND ANALYSIS
# ============================================================================

def print_detailed_comparison():
    """Prints detailed comparison of all approaches."""

    print("\n" + "=" * 70)
    print("DETAILED COMPARISON - EXECUTION FLOW & CHARACTERISTICS")
    print("=" * 70)

    print("""
╔═══════════════════════════════════════════════════════════════════════╗
║ APPROACH 1: LOOP-BASED (for + string concatenation)                   ║
╚═══════════════════════════════════════════════════════════════════════╝

Execution Flow:
  1. Initialize empty result string: result = ""
  2. Loop from end to start: for i in range(len(text) - 1, -1, -1)
  3. Each iteration: result += text[i]
  4. Return result

Example with "Hello":
  Iteration 1: result = "" + "o" = "o"
  Iteration 2: result = "o" + "l" = "ol"
  Iteration 3: result = "ol" + "l" = "oll"
  Iteration 4: result = "oll" + "e" = "olle"
  Iteration 5: result = "olle" + "H" = "olleH"
```

Time Complexity: O(n) - loop runs n times

Space Complexity: O(n) - creates new string

Performance: SLOWER ⚠

Issue: String concatenation with += is O(n) each time

Total: $O(n^2)$ in practice due to string immutability

Best For:

✓ Learning / educational purposes

✓ Custom logic during reversal

✓ Compatibility with very old Python

✓ When you need explicit control

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║ APPROACH 2: LOOP-BASED (list + join - OPTIMIZED) ║

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Execution Flow:

1. Initialize empty list: result = []

2. Loop from end to start: for i in range(len(text) - 1, -1, -1)

3. Each iteration: result.append(text[i])

4. Join all elements: return "".join(result)

Example with "Hello":

Build list: ["o", "l", "l", "e", "H"]

Join: "olleH"

Time Complexity: O(n) - loop runs n times

Space Complexity: O(n) - new list + string

Performance: FAST ✓

Why faster: list.append() is O(1), join() is O(n)

Total: O(n) which is optimal

Best For:

✓ When you need explicit iteration logic

✓ Educational purposes (shows optimization technique)

✓ Adding custom processing during reversal

✓ Performance-conscious iterative code

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║ APPROACH 3: BUILT-IN SLICING [::-1] ║

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Execution Flow:

1. Use Python slice notation: text[::-1]

2. [:] = from start to end

3. -1 = step size (backwards)

4. Returns new reversed string

Example with "Hello":

"Hello"[::-1] = "olleH"

Time Complexity: O(n) - must copy all characters

Space Complexity: O(n) - creates new reversed string

Performance: FASTEST ⚡⚡

Optimized at C level in CPython

Direct string reversal operation

Best For:

✓ Production code (most Pythonic)

✓ General use cases

✓ Performance-critical code

✓ Readable and idiomatic Python

✓ Recommended by Python community

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║ APPROACH 4: reversed() FUNCTION + join ║

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Execution Flow:

1. Create reverse iterator: reversed(text)

2. Join iterator into string: "".join(...)

3. Returns new reversed string

Example with "Hello":

reversed("Hello") → iterator

"".join(iterator) = "olleH"

Time Complexity: O(n)

Space Complexity: O(n)

Performance: VERY FAST ✓✓

Efficient iterator approach

Minimal overhead

Best For:

✓ When you need an iterator

✓ Functional programming style

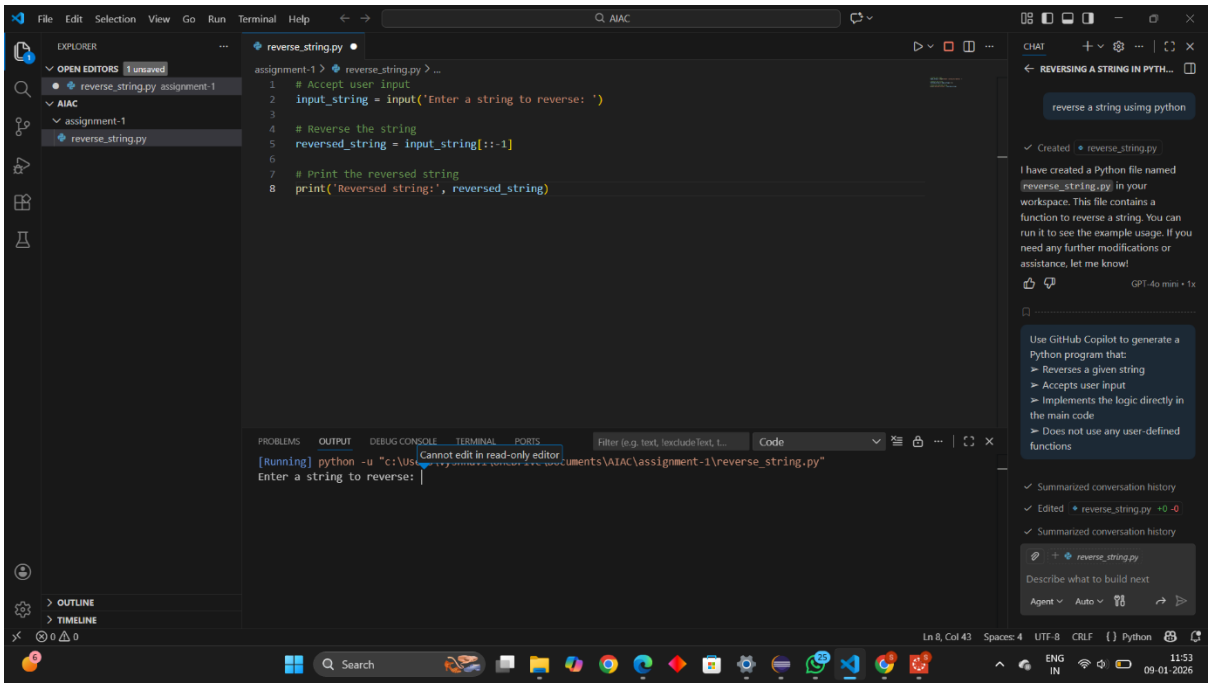
```
✓ Memory-efficient for large strings
✓ Pythonic alternative to slicing
""")

# ============================================================================
# COMPREHENSIVE COMPARISON TABLE
# ============================================================================

def print_comparison_table():
    """Prints comprehensive comparison table."""

    print("\n" + "=" * 70)
    print("COMPREHENSIVE COMPARISON TABLE")
    print("=" * 70)
    print("""
┌──────────────────────┬──────────────────┬──────────────────┬──────────────┐
│ Criterion            │ Loop (concat)    │ Loop (list+join) │ Slicing [::-1] │
├──────────────────────┼──────────────────┼──────────────────┼──────────────┤
│ Time Complexity      │ O(n²) practical  │ O(n) optimal     │ O(n) optimal │
│ Space Complexity     │ O(n)             │ O(n)             │ O(n)         │
│ Code Brevity         │ Medium (6 lines) │ Medium (6 lines) │ Very short (1)│
│ Readability          │ Good             │ Good             │ Excellent    │
│ Performance          │ Slow ⚠           │ Fast ✓           │ Fastest ⚡⚡  │
│ Pythonic Style       │ Not really       │ Somewhat         │ Yes ✓✓       │
│ Beginner Friendly    │ Yes ✓            │ Yes ✓            │ Somewhat     │
│ Extensibility        │ Easy ✓           │ Easy ✓           │ Hard         │
│ Production Ready     │ No               │ Yes ✓            │ Yes ✓✓       │
│ Large Input (1M)     │ SLOW ✗           │ FAST ✓           │ FASTEST ⚡⚡  │
└──────────────────────┴──────────────────┴──────────────────┴──────────────┘
""")
```

```
# ============================================================================
# WHEN TO USE EACH APPROACH
# ============================================================================

def print_recommendations():
    """Prints recommendations for each approach."""

    print("\n" + "=" * 70)
    print("RECOMMENDATIONS - WHEN TO USE EACH APPROACH")
    print("=" * 70)
    print("""
USE LOOP-BASED (String Concatenation) WHEN:
  ✓ Learning Python / studying algorithms
  ✓ Need explicit control over each character
  ✓ Adding custom logic during reversal
  ✗ NOT recommended for production code
  ✗ NOT recommended for large strings

USE LOOP-BASED (List + Join) WHEN:
  ✓ Need explicit iteration with custom logic
  ✓ Processing each character before reversal
  ✓ Educational demonstrations
  ✓ Performance matters and explicit approach preferred
  ✓ Compatible with functional programming style

USE BUILT-IN SLICING [::-1] WHEN:
  ✓ Production code (RECOMMENDED)
  ✓ General string reversal needed
  ✓ Maximum performance required
```

```
✓ Clean and readable code preferred
✓ Most common use case
✓ Working with large strings
✓ Following Python best practices

USE reversed() FUNCTION WHEN:
✓ Working with iterators
✓ Functional programming style
✓ Memory efficiency important
✓ Iterating without creating full string
✓ Working with iterables (not just strings)
""")

# ============================================================================
# MAIN EXECUTION
# ============================================================================

if __name__ == '__main__':
    # Test cases
    test_cases = [
        "Hello, World!",
        "Python",
        "racecar",
        "a" * 100,  # Large string
    ]

    # Run demonstrations
    for test_string in test_cases:
        test_all_approaches(test_string)
```

```
# Performance comparison with larger string
large_string = "Hello, World! " * 100  # 1400 characters
performance_comparison(large_string, iterations=5000)

# Print detailed analysis
print_detailed_comparison()

# Print comparison table
print_comparison_table()

# Print recommendations
print_recommendations()

print("\n" + "=" * 70)
print("FINAL VERDICT")
print("=" * 70)
print("""
🏆 RECOMMENDED FOR PRODUCTION: Slicing [::-1]
  - Fastest performance
  - Most Pythonic
  - Cleanest code
  - Best practices compliant

📚 RECOMMENDED FOR LEARNING: Loop-based approaches
  - Understand algorithms
  - Learn about optimization
  - Educational value

⚡ RECOMMENDED FOR PERFORMANCE: Either Slicing or reversed()
  - Both have O(n) complexity
  - Slicing is slightly faster in practice
```

""")


File Edit Selection View Go Run Terminal Help
AIAC
EXPLORER
OPEN EDITORS 1 unsaved
reverse_string.py assignment-1
AIAC
assignment-1
reverse_string.py
reverse_string.py
assignment-1 > reverse_string.py > ...
1 # Accept user input
2 input_string = input('Enter a string to reverse: ')
3
4 # Reverse the string
5 reversed_string = input_string[::-1]
6
7 # Print the reversed string
8 print('Reversed string:', reversed_string)
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
Filter (e.g. text, !excludeText, t...
Code
Cannot edit in read-only editor
[Running] python -u "c:\Users\Vyshnavi\OneDrive\Documents\AIAC\assignment-1\reverse_string.py"
Enter a string to reverse:
OUTLINE
TIMELINE
Ln 8, Col 43 Spaces: 4 UTF-8 CRLF { } Python
CHAT
REVERSING A STRING IN PYTH...
reverse a string usimg python
Created reverse_string.py
I have created a Python file named reverse_string.py in your workspace. This file contains a function to reverse a string. You can run it to see the example usage. If you need any further modifications or assistance, let me know!
GPT-4o mini • 1x
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
Summarized conversation history
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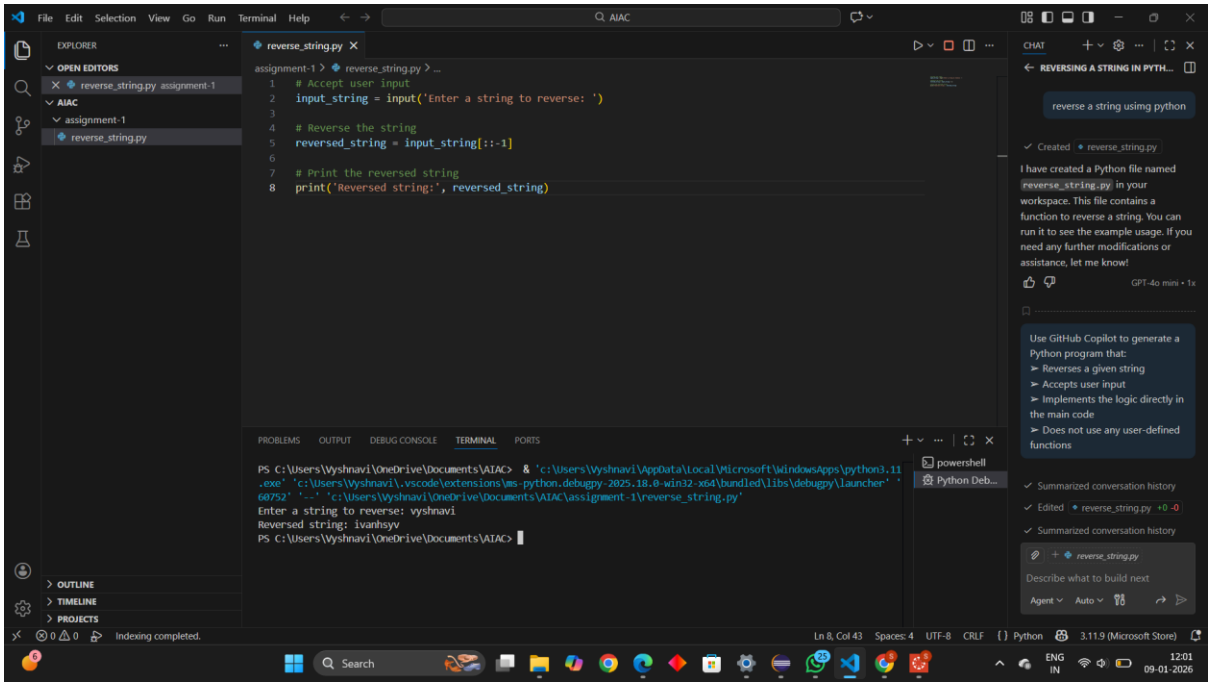
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reverse_string.py assignment-1
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assignment-1 > reverse_string.py > ...
1 # Accept user input
2 input_string = input('Enter a string to reverse: ')
3
4 # Reverse the string
5 reversed_string = input_string[::-1]
6
7 # Print the reversed string
8 print('Reversed string:', reversed_string)
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
powershell
Python Deb...
PS C:\Users\Vyshnavi\OneDrive\Documents\AIAC> & 'c:\Users\Vyshnavi\AppData\Local\Microsoft\WindowsApps\python3.11.exe' 'c:\Users\Vyshnavi\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '60752' '--' 'c:\Users\Vyshnavi\OneDrive\Documents\AIAC\assignment-1\reverse_string.py'
Enter a string to reverse: vyshnavi
Reversed string: ivanhsyv
PS C:\Users\Vyshnavi\OneDrive\Documents\AIAC>
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Indexing completed.
Ln 8, Col 43 Spaces: 4 UTF-8 CRLF { } Python 3.11.9 (Microsoft Store)
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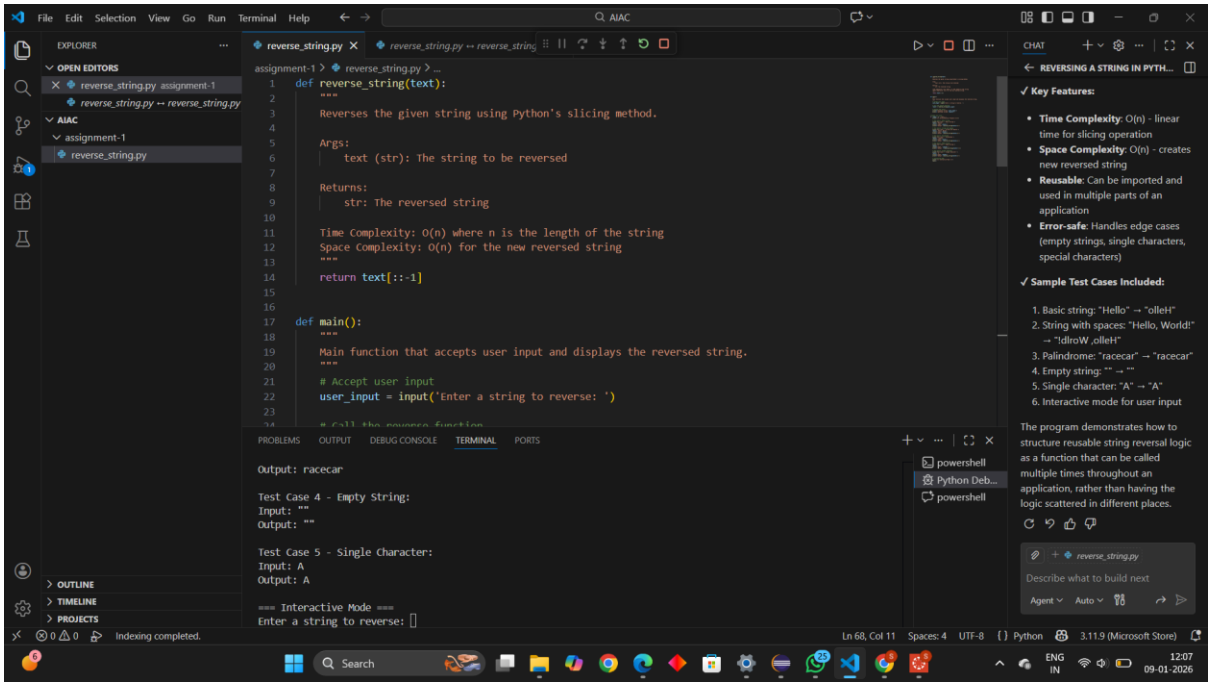
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assignment-1 > reverse_string.py > ...
def reverse_string(text):
"""
Reverses the given string using Python's slicing method.
Args:
text (str): The string to be reversed
Returns:
str: The reversed string
Time Complexity: O(n) where n is the length of the string
Space Complexity: O(n) for the new reversed string
"""
return text[::-1]
def main():
"""
Main function that accepts user input and displays the reversed string.
"""
# Accept user input
user_input = input('Enter a string to reverse: ')
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
powershell
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powershell
Output: racecar
Test Case 4 - Empty String:
Input: ""
Output: ""
Test Case 5 - Single Character:
Input: A
Output: A
=== Interactive Mode ===
Enter a string to reverse:
OUTLINE
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Indexing completed.
Ln 68, Col 11 Spaces: 4 UTF-8 Python 3.11.9 (Microsoft Store)
CHAT
REVERSING A STRING IN PYTH...
✓ Key Features:
Time Complexity: O(n) - linear time for slicing operation
Space Complexity: O(n) - creates new reversed string
Reusable: Can be imported and used in multiple parts of an application
Error-safe: Handles edge cases (empty strings, single characters, special characters)
✓ Sample Test Cases Included:
1. Basic string: "Hello" → "olleH"
2. String with spaces: "Hello, World!" → "!dlroW ,olleH"
3. Palindrome: "racecar" → "racecar"
4. Empty string: "" → ""
5. Single character: "A" → "A"
6. Interactive mode for user input
The program demonstrates how to structure reusable string reversal logic as a function that can be called multiple times throughout an application, rather than having the logic scattered in different places.
reverse_string.py
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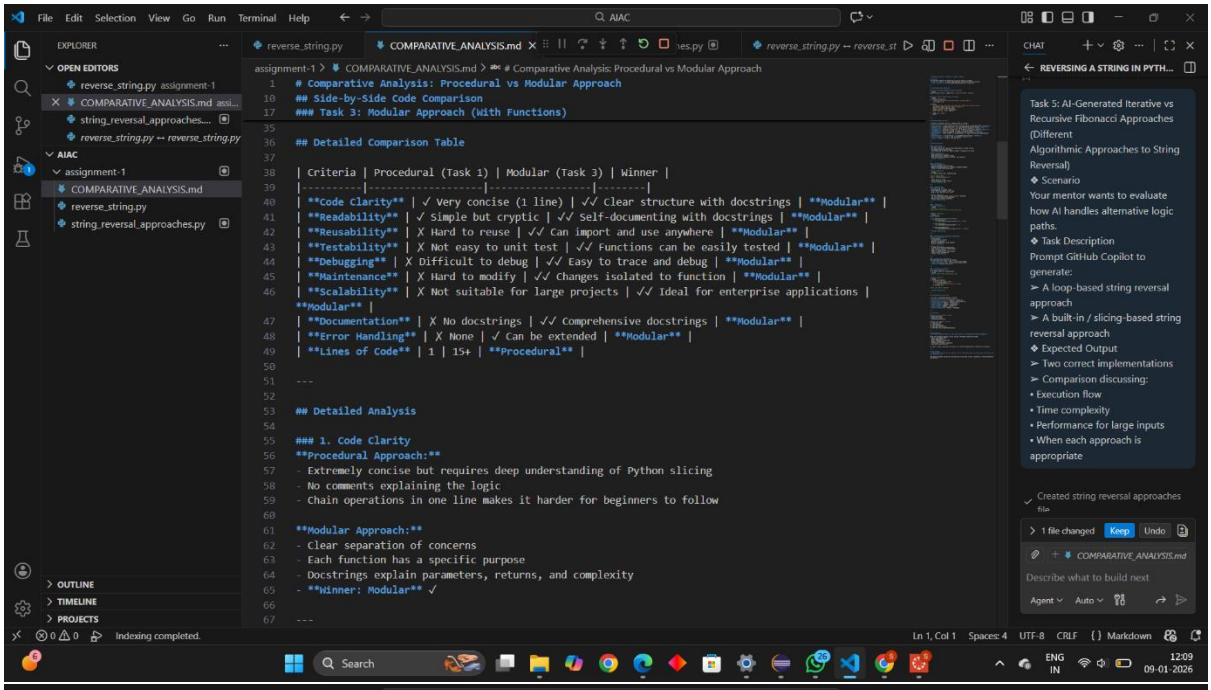
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reverse_string.py
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assignment-1 > COMPARATIVE_ANALYSIS.md > # Comparative Analysis: Procedural vs Modular Approach
Comparative Analysis: Procedural vs Modular Approach
Side-by-Side Code Comparison
Task 3: Modular Approach (With Functions)
Detailed Comparison Table
Criteria	Procedural (Task 1)	Modular (Task 3)	Winner
Code Clarity	✓ Very concise (1 line)	✓✓ Clear structure with docstrings	**Modular**
Readability	✓ Simple but cryptic	✓✓ Self-documenting with docstrings	**Modular**
Reusability	✗ Hard to reuse	✓✓ Can import and use anywhere	**Modular**
Testability	✗ Not easy to unit test	✓✓ Functions can be easily tested	**Modular**
Debugging	✗ Difficult to debug	✓✓ Easy to trace and debug	**Modular**
Maintenance	✗ Hard to modify	✓✓ Changes isolated to function	**Modular**
Scalability	✗ Not suitable for large projects	✓✓ Ideal for enterprise applications	**Modular**
Documentation	✗ No docstrings	✓✓ Comprehensive docstrings	**Modular**
Error Handling	✗ None	✓ Can be extended	**Modular**
Lines of Code	1	15+	**Procedural**

Detailed Analysis
1. Code Clarity
Procedural Approach:
- Extremely concise but requires deep understanding of Python slicing
- No comments explaining the logic
- Chain operations in one line makes it harder for beginners to follow
Modular Approach:
- Clear separation of concerns
- Each function has a specific purpose
- Docstrings explain parameters, returns, and complexity
- **Winner: Modular** ✓

CHAT
REVERSING A STRING IN PYTH...
Task 5: AI-Generated Iterative vs Recursive Fibonacci Approaches (Different Algorithmic Approaches to String Reversal)
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❖ 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
Created string reversal approaches file
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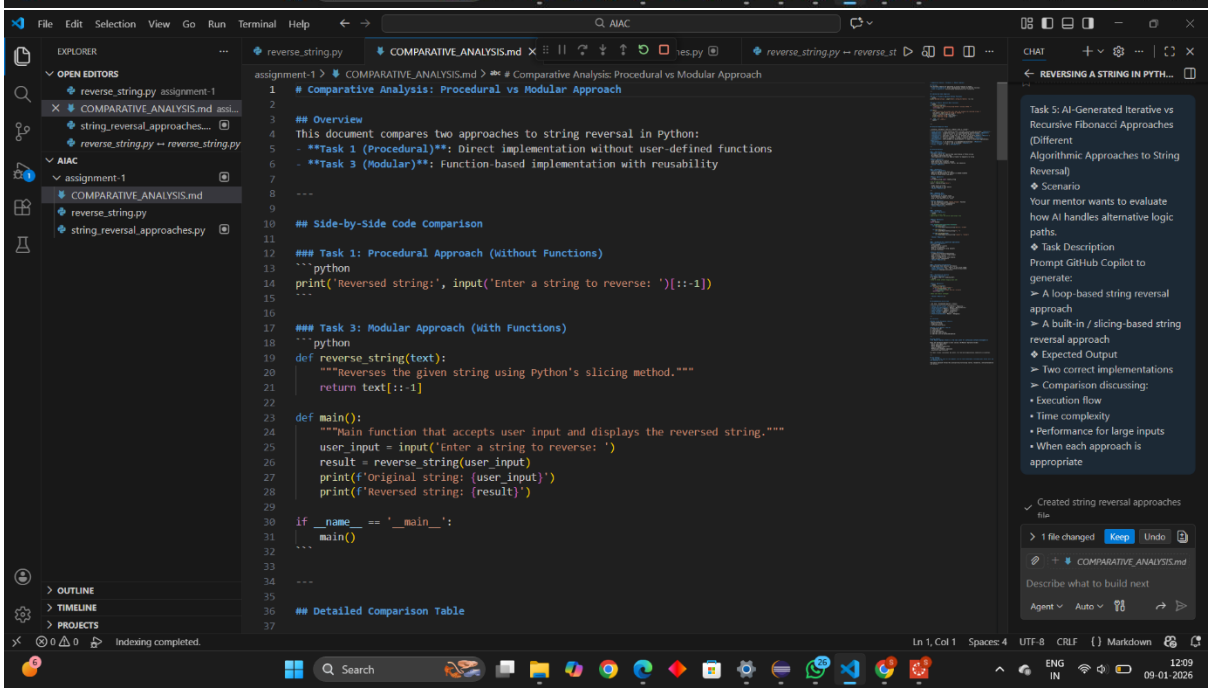
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assignment-1 > COMPARATIVE_ANALYSIS.md > # Comparative Analysis: Procedural vs Modular Approach
Comparative Analysis: Procedural vs Modular Approach
Overview
This document compares two approaches to string reversal in Python:
- **Task 1 (Procedural)**: Direct implementation without user-defined functions
- **Task 3 (Modular)**: Function-based implementation with reusability
---
Side-by-Side Code Comparison
Task 1: Procedural Approach (Without Functions)
```python
print('Reversed string:', input('Enter a string to reverse: ')[::-1])
```
Task 3: Modular Approach (With Functions)
```python
def reverse_string(text):
"""Reverses the given string using Python's slicing method."""
return text[::-1]
def main():
"""Main function that accepts user input and displays the reversed string."""
user_input = input('Enter a string to reverse: ')
result = reverse_string(user_input)
print(f'Original string: {user_input}')
print(f'Reversed string: {result}')
if __name__ == '__main__':
main()
```

Detailed Comparison Table
CHAT
REVERSING A STRING IN PYTH...
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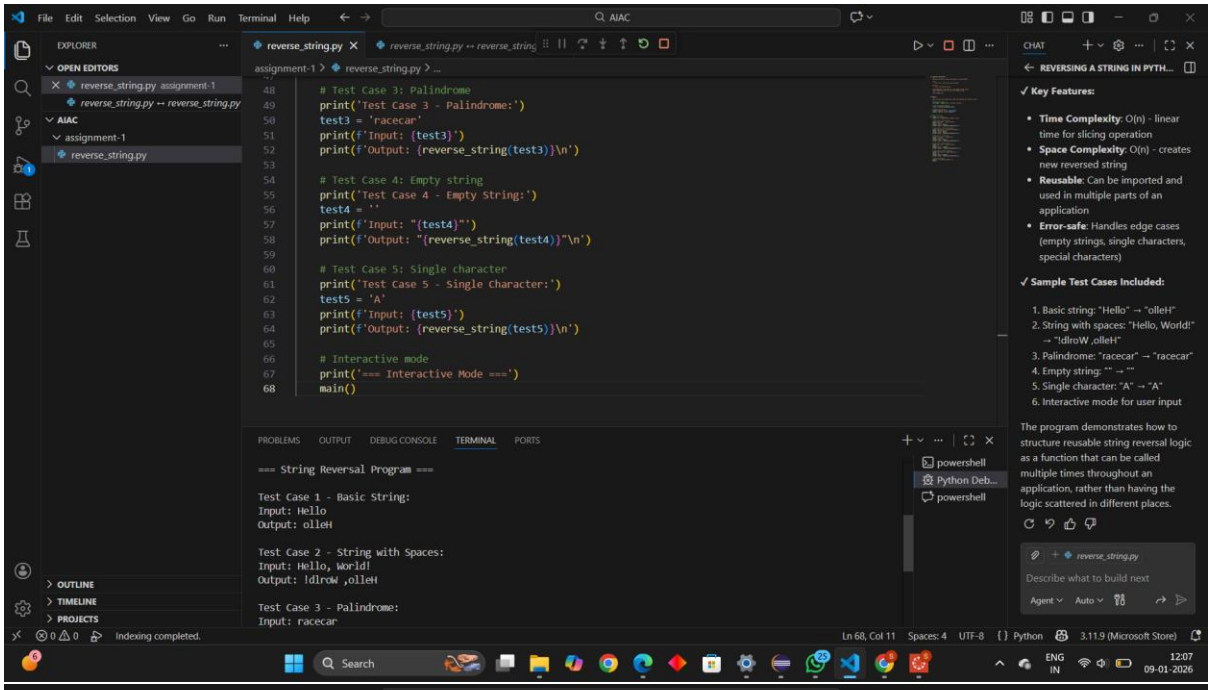
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assignment-1 > reverse_string.py > ...
# Test Case 3: Palindrome
print("Test Case 3 - Palindrome:")
test3 = 'racecar'
print(f'Input: {test3}')
print(f'Output: {reverse_string(test3)}\n')
# Test Case 4: Empty string
print("Test Case 4 - Empty String:")
test4 = ''
print(f'Input: "{test4}"')
print(f'Output: "{reverse_string(test4)}"\n')
# Test Case 5: Single character
print("Test Case 5 - Single Character:")
test5 = 'A'
print(f'Input: {test5}')
print(f'Output: {reverse_string(test5)}\n')
# Interactive mode
print("=== Interactive Mode ===")
main()
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
powershell
Python Deb...
powershell
=== String Reversal Program ===
Test Case 1 - Basic String:
Input: Hello
Output: olleH
Test Case 2 - String with Spaces:
Input: Hello, World!
Output: !dlroW ,olleH
Test Case 3 - Palindrome:
Input: racecar
OUTLINE
TIMELINE
PROJECTS
Indexing completed.
Ln 68, Col 11 Spaces: 4 UTF-8 Python 3.11.9 (Microsoft Store)
CHAT
REVERSING A STRING IN PYTH...
Key Features:
Time Complexity: O(n) - linear time for slicing operation
Space Complexity: O(n) - creates new reversed string
Reusable: Can be imported and used in multiple parts of an application
Error-safe: Handles edge cases (empty strings, single characters, special characters)
Sample Test Cases Included:
1. Basic string: "Hello" → "olleH"
2. String with spaces: "Hello, World!" → "!dlroW ,olleH"
3. Palindrome: "racecar" → "racecar"
4. Empty string: "" → ""
5. Single character: "A" → "A"
6. Interactive mode for user input
The program demonstrates how to structure reusable string reversal logic as a function that can be called multiple times throughout an application, rather than having the logic scattered in different places.
reverse_string.py
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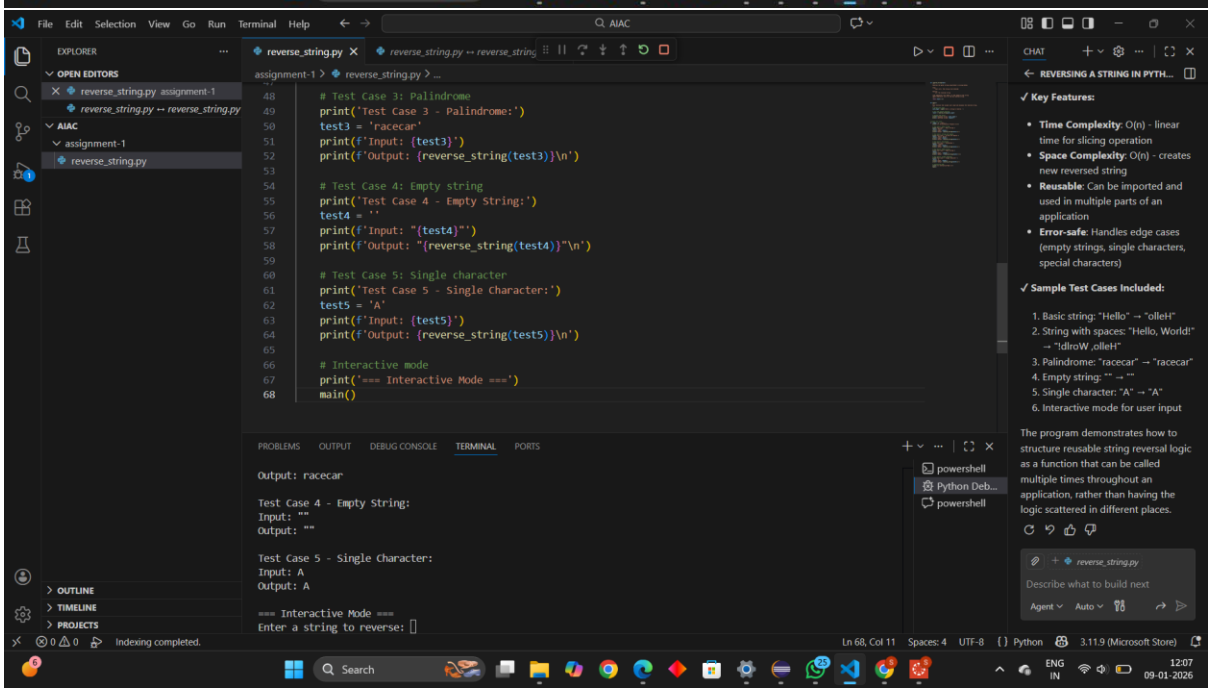
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assignment-1
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assignment-1 > reverse_string.py > ...
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print(f'Input: {test3}')
print(f'Output: {reverse_string(test3)}\n')
# Test Case 4: Empty string
print("Test Case 4 - Empty String:")
test4 = ''
print(f'Input: "{test4}"')
print(f'Output: "{reverse_string(test4)}"\n')
# Test Case 5: Single character
print("Test Case 5 - Single Character:")
test5 = 'A'
print(f'Input: {test5}')
print(f'Output: {reverse_string(test5)}\n')
# Interactive mode
print("=== Interactive Mode ===")
main()
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
powershell
Python Deb...
powershell
Output: racecar
Test Case 4 - Empty String:
Input: ""
Output: ""
Test Case 5 - Single Character:
Input: A
Output: A
=== Interactive Mode ===
Enter a string to reverse:
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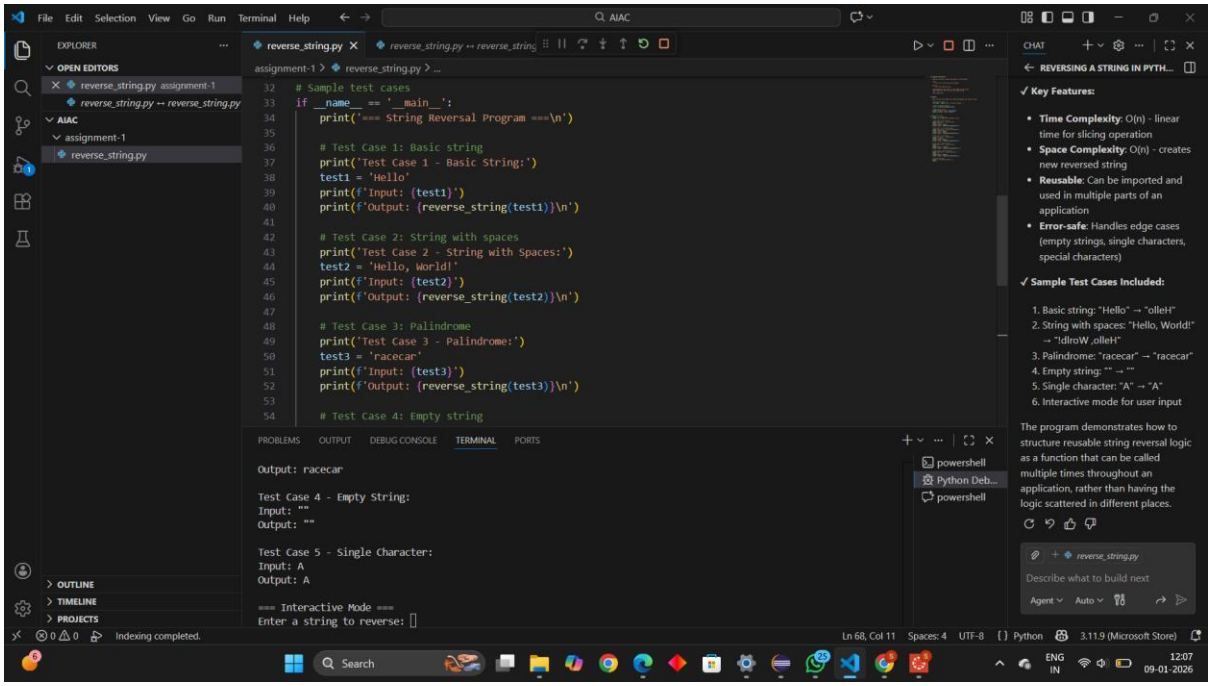
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reverse_string.py ↔ reverse_string
assignment-1 > reverse_string.py > ...
32 # Sample test cases
33 if __name__ == '__main__':
34 print('=== String Reversal Program ===\n')
35
36 # Test Case 1: Basic string
37 print('Test Case 1 - Basic String:')
38 test1 = 'Hello'
39 print(f'Input: {test1}')
40 print(f'Output: {reverse_string(test1)}\n')
41
42 # Test Case 2: String with spaces
43 print('Test Case 2 - String with Spaces:')
44 test2 = 'Hello, World!'
45 print(f'Input: {test2}')
46 print(f'Output: {reverse_string(test2)}\n')
47
48 # Test Case 3: Palindrome
49 print('Test Case 3 - Palindrome:')
50 test3 = 'racecar'
51 print(f'Input: {test3}')
52 print(f'Output: {reverse_string(test3)}\n')
53
54 # Test Case 4: Empty string
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
Output: racecar
Test Case 4 - Empty String:
Input: ""
Output: ""
Test Case 5 - Single Character:
Input: A
Output: A
=== Interactive Mode ===
Enter a string to reverse:
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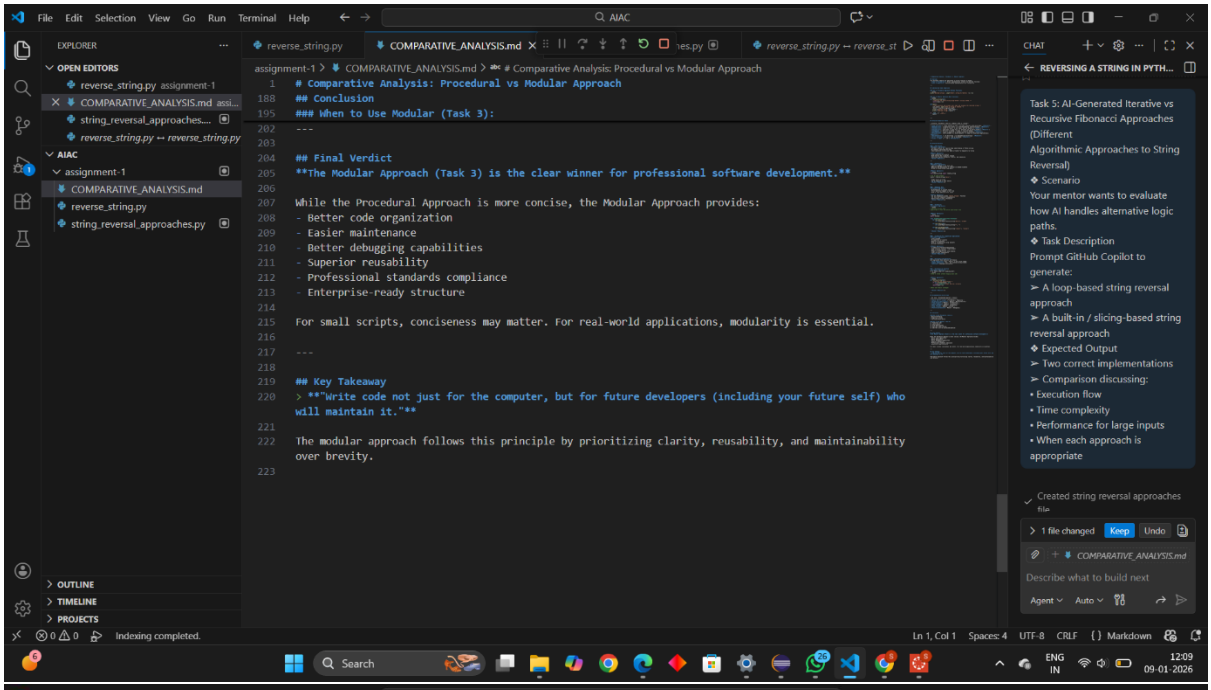
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assignment-1 > COMPARATIVE_ANALYSIS.md > # Comparative Analysis: Procedural vs Modular Approach
Comparative Analysis: Procedural vs Modular Approach
Conclusion
When to Use Modular (Task 3):

Final Verdict
The Modular Approach (Task 3) is the clear winner for professional software development.
While the Procedural Approach is more concise, the Modular Approach provides:
- Better code organization
- Easier maintenance
- Better debugging capabilities
- Superior reusability
- Professional standards compliance
- Enterprise-ready structure
For small scripts, conciseness may matter. For real-world applications, modularity is essential.

Key Takeaway
> **"Write code not just for the computer, but for future developers (including your future self) who will maintain it."**
The modular approach follows this principle by prioritizing clarity, reusability, and maintainability over brevity.
CHAT
REVERSING A STRING IN PYTH...
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➢ Two correct implementations
➢ Comparison discussing:
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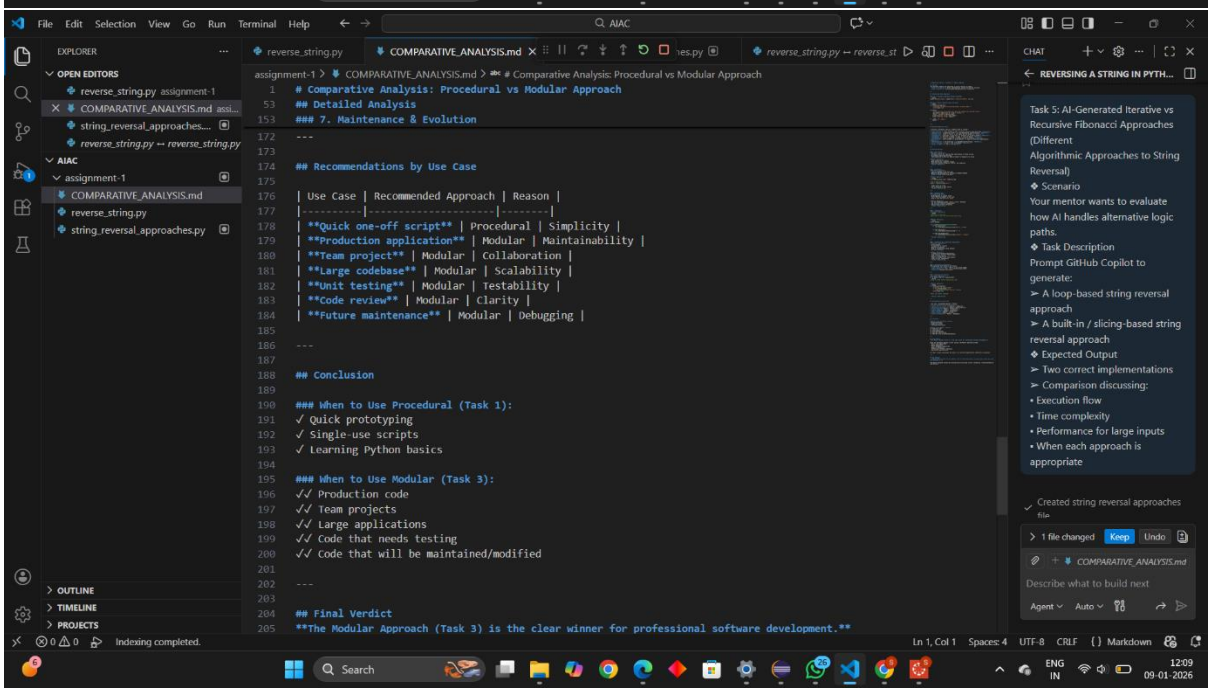
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assignment-1 > COMPARATIVE_ANALYSIS.md > # Comparative Analysis: Procedural vs Modular Approach
Comparative Analysis: Procedural vs Modular Approach
Detailed Analysis
7. Maintenance & Evolution

Recommendations by Use Case
Use Case	Recommended Approach	Reason
Quick one-off script	Procedural	Simplicity
Production application	Modular	Maintainability
Team project	Modular	Collaboration
Large codebase	Modular	Scalability
Unit testing	Modular	Testability
Code review	Modular	Clarity
Future maintenance	Modular	Debugging

Conclusion
When to Use Procedural (Task 1):
✓ Quick prototyping
✓ Single-use scripts
✓ Learning Python basics
When to Use Modular (Task 3):
✓✓ Production code
✓✓ Team projects
✓✓ Large applications
✓✓ Code that needs testing
✓✓ Code that will be maintained/modified

Final Verdict
The Modular Approach (Task 3) is the clear winner for professional software development.
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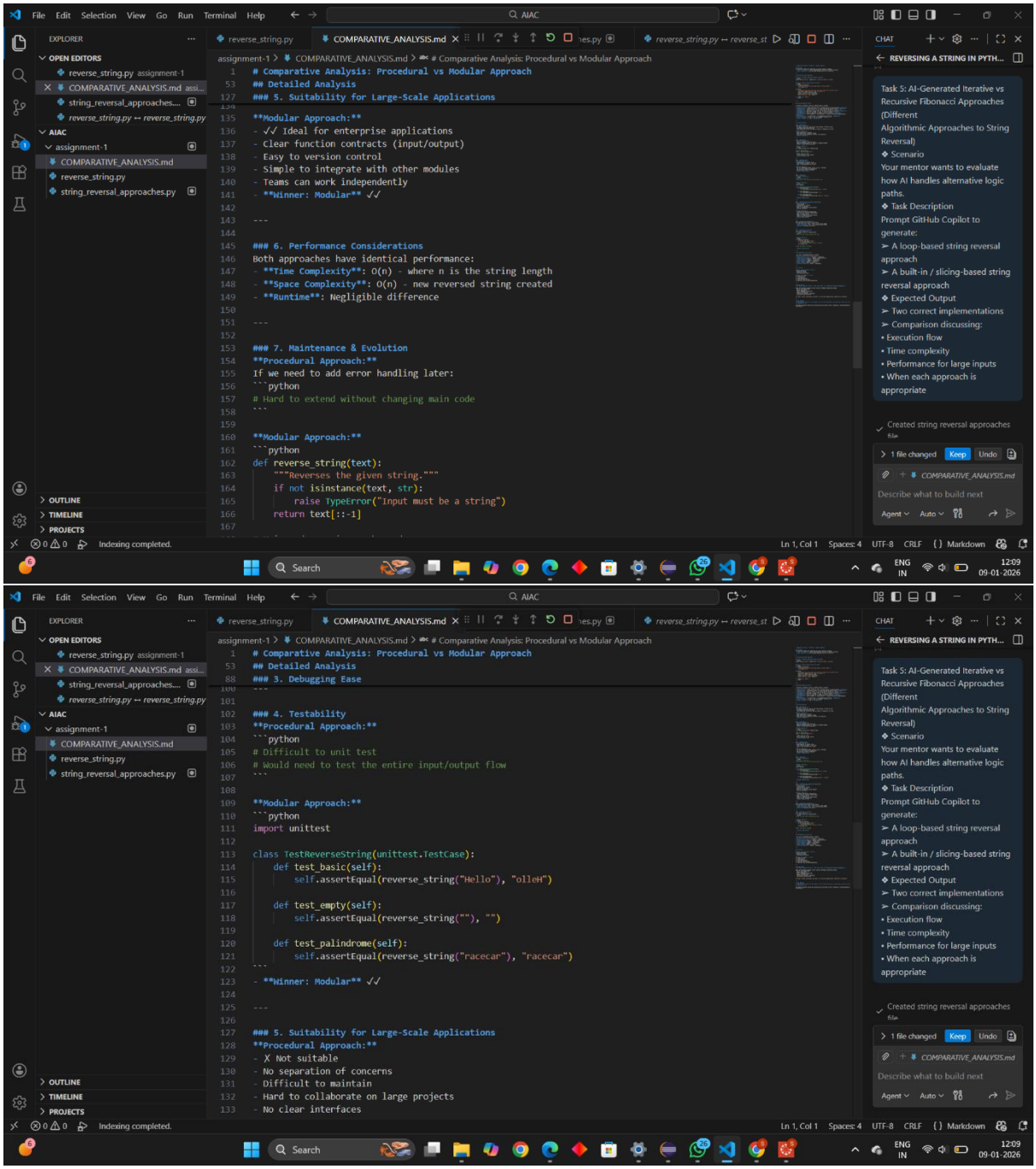
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assignment-1 > COMPARATIVE_ANALYSIS.md > # Comparative Analysis: Procedural vs Modular Approach
Comparative Analysis: Procedural vs Modular Approach
Detailed Analysis
5. Suitability for Large-Scale Applications
Modular Approach:
- ✓✓ Ideal for enterprise applications
- Clear function contracts (input/output)
- Easy to version control
- Simple to integrate with other modules
- Teams can work independently
- **Winner: Modular** ✓✓
---
6. Performance Considerations
Both approaches have identical performance:
- **Time Complexity**: O(n) - where n is the string length
- **Space Complexity**: O(n) - new reversed string created
- **Runtime**: Negligible difference
---
7. Maintenance & Evolution
Procedural Approach:
If we need to add error handling later:
```python
# Hard to extend without changing main code
```
Modular Approach:
```python
def reverse_string(text):
"""Reverses the given string."""
if not isinstance(text, str):
raise TypeError("Input must be a string")
return text[::-1]
CHAT
REVERSING A STRING IN PYTH...
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❖ Scenario
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❖ Task Description
Prompt GitHub Copilot to generate:
➢ A loop-based string reversal approach
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❖ Expected Output
➢ Two correct implementations
➢ Comparison discussing:
• Execution flow
• Time complexity
• Performance for large inputs
• When each approach is appropriate
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assignment-1 > COMPARATIVE_ANALYSIS.md > # Comparative Analysis: Procedural vs Modular Approach
# Comparative Analysis: Procedural vs Modular Approach
## Detailed Analysis
### 3. Debugging Ease
---
### 4. Testability
**Procedural Approach:**
```python
# Difficult to unit test
# Would need to test the entire input/output flow
```
Modular Approach:
```python
import unittest
class TestReverseString(unittest.TestCase):
def test_basic(self):
self.assertEqual(reverse_string("Hello"), "olleH")
def test_empty(self):
self.assertEqual(reverse_string(""), "")
def test_palindrome(self):
self.assertEqual(reverse_string("racecar"), "racecar")
```
- **Winner: Modular** ✓✓
---
5. Suitability for Large-Scale Applications
Procedural Approach:
- ✗ Not suitable
- No separation of concerns
- Difficult to maintain
- Hard to collaborate on large projects
- No clear interfaces
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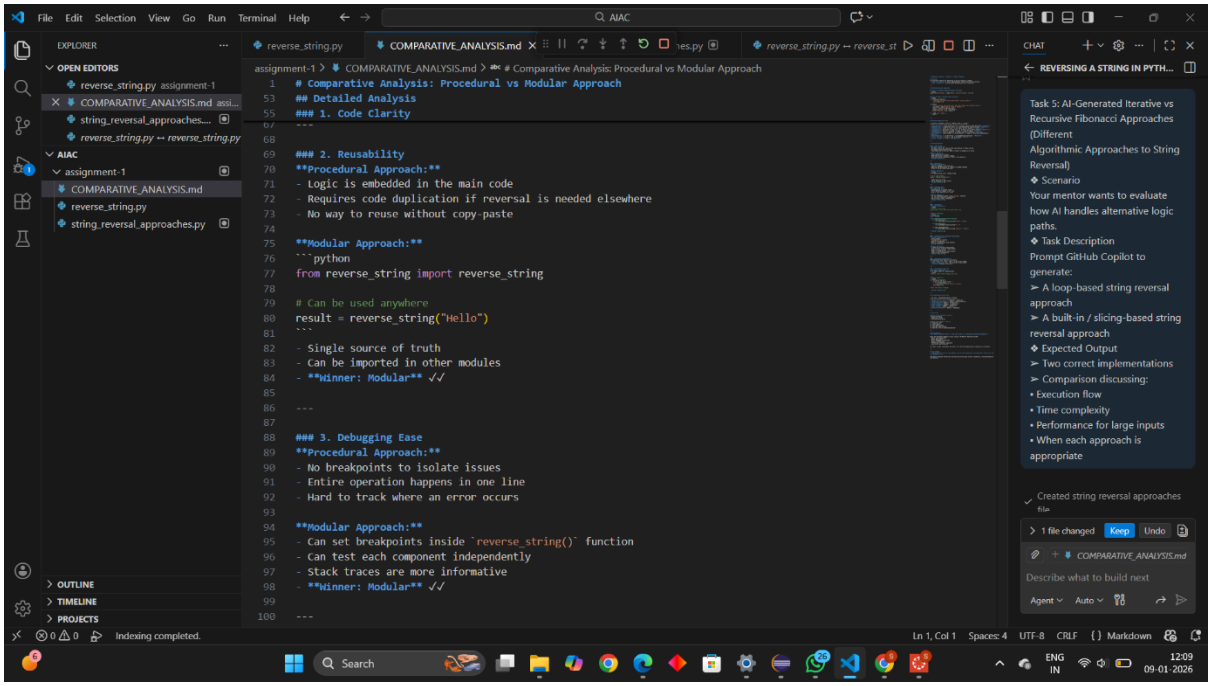
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assignment-1 > COMPARATIVE_ANALYSIS.md > # Comparative Analysis: Procedural vs Modular Approach
Comparative Analysis: Procedural vs Modular Approach
Detailed Analysis
1. Code Clarity
2. Reusability
Procedural Approach:
- Logic is embedded in the main code
- Requires code duplication if reversal is needed elsewhere
- No way to reuse without copy-paste
Modular Approach:
```python
from reverse_string import reverse_string
# Can be used anywhere
result = reverse_string("Hello")
```
- Single source of truth
- Can be imported in other modules
- **Winner: Modular** ✓✓
---
3. Debugging Ease
Procedural Approach:
- No breakpoints to isolate issues
- Entire operation happens in one line
- Hard to track where an error occurs
Modular Approach:
- Can set breakpoints inside `reverse_string()` function
- Can test each component independently
- Stack traces are more informative
- **Winner: Modular** ✓✓

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