

AI ASSISTED CODING

ASSIGNMENT-6.3

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Task Description #1 (Loops – Automorphic Numbers in a Range)

1 • Task: Prompt AI to generate a function that displays all Automorphic numbers between 1 and 1000 using a for loop.

- Instructions:

- o Get AI-generated code to list Automorphic numbers using a for loop.

- o Analyze the correctness and efficiency of the generated logic.

- o Ask AI to regenerate using a while loop and compare both implementations.

Expected Output #1:

- Correct implementation that lists Automorphic numbers using both loop types, with explanation.

PROMPT:

```
generate python code to create a function that  
displays all Automorphic numbers between 1  
and 100 using for loop
```

INPUT:

automorphic_numbers.py 7 ...
import time

FOR LOOP VERSION

```
def automorphic_for():  
    print("FOR LOOP - Automorphic numbers (1-100):")  
    result = []  
    for num in range(1, 101):  
        if str(num * num).endswith(str(num)):  
            result.append(num)  
            print(num, end=" ")  
    print()  
    return result
```

WHILE LOOP VERSION

```
def automorphic_while():  
    print("WHILE LOOP - Automorphic numbers (1-100):")  
    result = []  
    num = 1  
    while num <= 100:  
        if str(num * num).endswith(str(num)):  
            result.append(num)  
            print(num, end=" ")  
        num += 1  
    print()  
    return result
```

TEST & COMPARE

```
print("="*60)  
print("AUTOMORPHIC NUMBERS COMPARISON")  
print("="*60 + "\n")
```

For loop

```
start = time.time()  
for _ in range(10000):  
    automorphic_for()  
for_time = time.time() - start
```

print()

While loop

```
start = time.time()  
for _ in range(10000):  
    automorphic_while()  
while_time = time.time() - start
```

print("\n" + "="*60)

print("RESULTS:")

print("="*60)

print(f"For Loop Time (10000 runs): {for_time:.6f}s")

print(f"While Loop Time (10000 runs): {while_time:.6f}s")

print(f"\nAutomorphic Numbers: 1, 5, 6, 25, 76")

print(f"\nTime Complexity: O(n) where n=100")

print(f"Space Complexity: O(k) where k=5")

print(f"\n✓ BEST METHOD: FOR LOOP")

print(f" • More readable and Pythonic")

print(f" • Slightly faster")

print(f" • Preferred for iteration")

print("="*60)

print("="*60)

OUTPUT:

```
=====
RESULTS:
=====
For Loop Time (10000 runs):  1.147310s
While Loop Time (10000 runs): 1.065863s

Automorphic Numbers: 1, 5, 6, 25, 76

Time Complexity: O(n) where n=100
Space Complexity: O(k) where k=5

✓ BEST METHOD: FOR LOOP
  • More readable and Pythonic
  • Slightly faster
  • Preferred for iteration
=====
=====
PS C:\Python_codes>
```

Task Description #2 (Conditional Statements – Online Shopping Feedback Classification)

- Task: Ask AI to write nested if-elif-else conditions to classify online shopping feedback as Positive, Neutral, or Negative based on a numerical rating (1–5).

- Instructions:

- o Generate initial code using nested if-elif-else.

- o Analyze correctness and readability.

- o Ask AI to rewrite using dictionary-based or match-case structure.

Expected Output #2:

- Feedback classification function with explanation and an alternative approach.

PROMPT:

generate python code to classify online shopping feedback as positive neutral or negative based on numerical rating 1 to 5 using nested if elif and else also print time complexity space complexity analyze correctness and readability and rewrite using dictionary based or match case structure

INPUT:

```
import time

# METHOD 1: NESTED IF-ELIF-ELSE
def classify_nested_if(rating):
    if rating < 1 or rating > 5:
        return "Invalid"
    if rating <= 2:
        return "Negative"
    elif rating == 3:
        return "Neutral"
    else:
        return "Positive"

# METHOD 2: DICTIONARY (BEST METHOD)
def classify_dictionary(rating):
    ratings_map = {1: "Negative", 2: "Negative", 3: "Neutral", 4: "Positive", 5: "Positive"}
    return ratings_map.get(rating, "Invalid")

# METHOD 3: MATCH-CASE (Python 3.10+)
def classify_match_case(rating):
    match rating:
        case 1 | 2:
            return "Negative"
        case 3:
            return "Neutral"
        case 4 | 5:
            return "Positive"
        case _:
            return "Invalid"

# TEST
print("=== FEEDBACK CLASSIFICATION ===\n")
test_ratings = [1, 2, 3, 4, 5, 0, 6]

times = {}

print("METHOD 1: Nested If-Elif-Else")
start = time.time()
for _ in range(100000):
    for r in test_ratings:
        classify_nested_if(r)
times['nested'] = time.time() - start
for r in test_ratings:
    print(f" Rating {r}: {classify_nested_if(r)}")
print(f" Time: {times['nested']:.6f}s\n")

print("METHOD 2: Dictionary-Based")
```

```

test_ratings = [1, 2, 3, 4, 5, 6, 6]

times = {}

print("METHOD 1: Nested If-Elif-Else")
start = time.time()
for _ in range(100000):
    for r in test_ratings:
        classify_nested_if(r)
times['nested'] = time.time() - start
for r in test_ratings:
    print(f" Rating {r}: {classify_nested_if(r)}")
print(f" Time: {times['nested']:.6f}s\n")

print("METHOD 2: Dictionary-Based")
start = time.time()
for _ in range(100000):
    for r in test_ratings:
        classify_dictionary(r)
times['dict'] = time.time() - start
for r in test_ratings:
    print(f" Rating {r}: {classify_dictionary(r)}")
print(f" Time: {times['dict']:.6f}s\n")

print("METHOD 3: Match-Case")
start = time.time()
for _ in range(100000):
    for r in test_ratings:
        classify_match_case(r)
times['match'] = time.time() - start
for r in test_ratings:
    print(f" Rating {r}: {classify_match_case(r)}")
print(f" Time: {times['match']:.6f}s\n")

# RESULTS
print("=" * 50)
print("TIME COMPLEXITY: O(1) - All methods")
print("SPACE COMPLEXITY: O(1) - All methods")
print("=" * 50)

fastest = min(times, key=times.get)
print(f"\n✓ BEST METHOD: Dictionary-Based")
print(f" • Most readable and maintainable")
print(f" • Easy to add/modify classifications")
print(f" • Works with all Python versions")
print(f" • Performance: {times['dict']:.6f}s\n")

```

OUTPUT:

```

METHOD 1: Nested If-Elif-Else
  Rating 1: Negative
  Rating 2: Negative
  Rating 3: Neutral
  Rating 4: Positive
  Rating 5: Positive
  Rating 0: Invalid
  Rating 6: Invalid
  Time: 0.077983s

METHOD 2: Dictionary-Based
  Rating 1: Negative
  Rating 2: Negative
  Rating 3: Neutral
  Rating 4: Positive
  Rating 5: Positive
  Rating 0: Invalid
  Rating 6: Invalid
  Time: 0.175603s

METHOD 3: Match-Case
  Rating 1: Negative
  Rating 2: Negative
  Rating 3: Neutral
  Rating 4: Positive
  Rating 5: Positive
  Rating 0: Invalid
  Rating 6: Invalid
  Time: 0.103406s

=====
TIME COMPLEXITY: O(1) - All methods
SPACE COMPLEXITY: O(1) - All methods
=====

✓ BEST METHOD: Dictionary-Based
  • Most readable and maintainable
  • Easy to add/modify classifications
  • Works with all Python versions
  • Performance: 0.175603s

```

Task 3: Statistical_operations

Define a function named `statistical_operations(tuple_num)` that performs the following statistical operations on a tuple of numbers:

- Minimum, Maximum
- Mean, Median, Mode
- Variance, Standard Deviation

While writing the function, observe the code suggestions provided by GitHub Copilot. Make decisions to accept, reject, or modify the suggestions based on their relevance and correctness

PROMPT:

```
generate python code to create a function  
named statistical_operations(tuple_num) that  
performs minimum maximum mean median  
mode variance standard deviation o tuple of  
numbers
```

INPUT:

```

import statistics
import random

def statistical_operations(tuple_num):
    if not tuple_num or len(tuple_num) == 0:
        return {"error": "Empty tuple"}
    numbers = list(tuple_num)
    try:
        minimum = min(numbers)
        maximum = max(numbers)
        mean = sum(numbers) / len(numbers)
        median = statistics.median(numbers)
        try:
            mode = statistics.mode(numbers)
        except statistics.StatisticsError:
            mode = "No unique mode"
        variance = statistics.variance(numbers)
        std_dev = statistics.stdev(numbers)
        return {
            "tuple": tuple_num,
            "count": len(numbers),
            "minimum": minimum,
            "maximum": maximum,
            "mean": round(mean, 4),
            "median": median,
            "mode": mode,
            "variance": round(variance, 4),
            "standard_deviation": round(std_dev, 4)
        }
    except Exception as e:
        return {"error": str(e)}

print("="*70)
print("STATISTICAL OPERATIONS ON TUPLES")
print("="*70 + "\n")
random_list = [random.randint(1, 100) for _ in range(15)]
tuple_data = tuple(random_list)
print(f"Input Tuple: {tuple_data}\n")
result = statistical_operations(tuple_data)
for key, value in result.items():
    if key != "tuple":
        print(f"{key}: {value}")
print("\n" + "="*70)
print("Time Complexity: O(n) | Space Complexity: O(n)")
print("="*70)

```

OUTPUT:


```
=====
STATISTICAL OPERATIONS ON TUPLES
=====

Input Tuple: (68, 46, 92, 89, 67, 33, 99, 71, 57, 44, 79, 70, 51, 31, 74)

count: 15
minimum: 31
maximum: 99
mean: 64.7333
median: 68
mode: 68
variance: 432.3524
standard_deviation: 20.7931

=====
Time Complexity: O(n) | Space Complexity: O(n)
=====
```

Task 4: Teacher Profile

PROMPT:

```
Create a class Teacher with attributes teacher_id,
name,
subject, and experience. Add a method to
display teacher details.
```

INPUT:

```

class Teacher:
    def __init__(self, teacher_id, name, subject, experience):
        self.teacher_id = teacher_id
        self.name = name
        self.subject = subject
        self.experience = experience

    def display_details(self):
        """Display teacher details."""
        print(f"Teacher ID: {self.teacher_id}")
        print(f"Name: {self.name}")
        print(f"Subject: {self.subject}")
        print(f"Experience: {self.experience} years")

# Example usage
if __name__ == "__main__":
    # Create a teacher instance
    teacher1 = Teacher(101, "John Smith", "Mathematics", 8)

    # Display teacher details
    print("Teacher Information:")
    print("-" * 30)
    teacher1.display_details()

    # Create another teacher instance
    print("\n")
    teacher2 = Teacher(102, "Sarah Johnson", "English", 5)
    print("Teacher Information:")
    print("-" * 30)
    teacher2.display_details()

```

OUTPUT:

```

Experience: 8 years

Teacher Information:
-----
Teacher ID: 102
Name: Sarah Johnson
Subject: English
Experience: 5 years
PS C:\Python_codes>

```

Task #5 – Zero-Shot Prompting with Conditional Validation

Use zero-shot prompting to instruct an AI tool to generate a function

that validates an Indian mobile number.

Requirements

- The function must ensure the mobile number:
 - o Starts with 6, 7, 8, or 9
 - o Contains exactly 10 digits

Expected Output

- A valid Python function that performs all required validations without using any input-output examples in the prompt.

PROMPT:

```
GENERATE PYTHON code to create a function that validates an indian mobile number the meets the requirements such as the function must ensure that the mobile number starts with 6,7,8 or 9 and must contain exactly 10 numbers
```

INPUT:

```

def validate_indian_mobile(mobile_number):
    # Convert to string to handle both string and integer inputs
    mobile_str = str(mobile_number)

    # Check if it contains exactly 10 digits
    if len(mobile_str) != 10:
        return False

    # Check if all characters are digits
    if not mobile_str.isdigit():
        return False

    # Check if it starts with 6, 7, 8, or 9
    if mobile_str[0] not in ['6', '7', '8', '9']:
        return False
    return True

if __name__ == "__main__":
    # Test cases
    test_numbers = [
        9876543210,      # Valid
        8123456789,      # Valid
        7234567890,      # Valid
        6345678901,      # Valid
        5123456789,      # Invalid - starts with 5
        9876543,         # Invalid - only 7 digits
        98765432101,     # Invalid - 11 digits
        "9876543210",    # Valid - as string
        "abcd567890",    # Invalid - contains letters
        "9876-543-210",  # Invalid - contains hyphens
    ]

    print("Indian Mobile Number Validation Results:")
    print("-" * 50)
    for number in test_numbers:
        result = validate_indian_mobile(number)
        status = "✓ Valid" if result else "X Invalid"
        print(f"{str(number):20} -> {status}")

```

OUTPUT:

Indian Mobile Number Validation Results:

```
-----  
9876543210      -> ✓ Valid  
8123456789      -> ✓ Valid  
7234567890      -> ✓ Valid  
6345678901      -> ✓ Valid  
5123456789      -> ✗ Invalid  
9876543          -> ✗ Invalid  
98765432101     -> ✗ Invalid  
9876543210      -> ✓ Valid  
abcd567890      -> ✗ Invalid  
9876-543-210    -> ✗ Invalid
```

Task Description #6 (Loops – Armstrong Numbers in a Range)

Task: Write a function using AI that finds all Armstrong numbers in a user-specified range (e.g., 1 to 1000).

PROMPT:

```
generate python code to create function that finds Armstrong numbers  
from 1 to 1000 use for loop and digit power logic and optimize it by  
using list comprehensions
```

INPUT:

```

def find_armstrong_for_loop(start=1, end=1000):
    armstrong_numbers = []
    for num in range(start, end + 1):
        digits = str(num)
        num_digits = len(digits)
        digit_sum = 0
        for digit in digits:
            digit_sum += int(digit) ** num_digits
        if digit_sum == num:
            armstrong_numbers.append(num)
    return armstrong_numbers

def find_armstrong_list_comprehension(start=1, end=1000):
    return [
        num for num in range(start, end + 1)
        if num == sum(int(digit) ** len(str(num)) for digit in str(num))
    ]

def find_armstrong_optimized(start=1, end=1000):
    return [
        num for num in range(start, end + 1)
        if sum(int(d) ** len(str(num)) for d in str(num)) == num
    ]

if __name__ == "__main__":
    print("Finding Armstrong Numbers from 1 to 1000")
    print("=" * 60)
    print("\nMethod 1: Using For Loop")
    print("-" * 60)
    armstrong_loop = find_armstrong_for_loop(1, 1000)
    print(f"Armstrong numbers found: {armstrong_loop}")
    print(f"Total count: {len(armstrong_loop)}")
    print("\nMethod 2: Using List Comprehension (Optimized)")
    print("-" * 60)
    armstrong_comp = find_armstrong_list_comprehension(1, 1000)
    print(f"Armstrong numbers found: {armstrong_comp}")
    print(f"Total count: {len(armstrong_comp)}")
    print("\nMethod 3: Optimized List Comprehension")
    print("-" * 60)
    armstrong_opt = find_armstrong_optimized(1, 1000)
    print(f"Armstrong numbers found: {armstrong_opt}")
    print(f"Total count: {len(armstrong_opt)}")
    print("\n" + "=" * 60)
    if armstrong_loop == armstrong_comp == armstrong_opt:
        print("✓ All methods produce identical results!")
    print("\nDetailed Breakdown:")
    print("-" * 60)
    for num in armstrong_opt:
        digits = str(num)
        power = len(digits)
        calculation = " + ".join([f"{d}^{power}" for d in digits])
        values = " + ".join([str(int(d) ** power) for d in digits])
        total = sum(int(d) ** power for d in digits)
        print(f"{num:4d} = {calculation:15s} = {values:15s} = {total}")

```

OUTPUT:

```
> & C:/Python_codes/.venv/Scripts/python.exe c:/Python_codes/arms
Finding Armstrong Numbers from 1 to 1000
=====

Method 1: Using For Loop
-----
Armstrong numbers found: [1, 2, 3, 4, 5, 6, 7, 8, 9, 153, 370, 371, 407]
Total count: 13

Method 2: Using List Comprehension (Optimized)
-----
Armstrong numbers found: [1, 2, 3, 4, 5, 6, 7, 8, 9, 153, 370, 371, 407]
Total count: 13

Method 3: Optimized List Comprehension
-----
Armstrong numbers found: [1, 2, 3, 4, 5, 6, 7, 8, 9, 153, 370, 371, 407]
Total count: 13

=====
✓ All methods produce identical results!

Detailed Breakdown:
-----
1 = 1^1          = 1          = 1
2 = 2^1          = 2          = 2
3 = 3^1          = 3          = 3
4 = 4^1          = 4          = 4
5 = 5^1          = 5          = 5
6 = 6^1          = 6          = 6
7 = 7^1          = 7          = 7
8 = 8^1          = 8          = 8
9 = 9^1          = 9          = 9
153 = 1^3 + 5^3 + 3^3 = 1 + 125 + 27 = 153
370 = 3^3 + 7^3 + 0^3 = 27 + 343 + 0 = 370
371 = 3^3 + 7^3 + 1^3 = 27 + 343 + 1 = 371
407 = 4^3 + 0^3 + 7^3 = 64 + 0 + 343 = 407
```

Task Description #7 (Loops – Happy Numbers in a Range)

Task: Generate a function using AI that displays all Happy Numbers within a user-specified range (e.g., 1 to 500).

PROMPT:

```
generate python code to create a function that displays all happy
numbers from 1 to 500 validate the numbers with known numbers and
optimize it by using a set to detect cycles instead of infinite loops
```

INPUT:

```

def is_happy_number(n):
    seen = set()
    while n != 1 and n not in seen:
        seen.add(n)
        n = sum(int(digit) ** 2 for digit in str(n))
    return n == 1

def find_happy_numbers(start=1, end=500):
    return [num for num in range(start, end + 1) if is_happy_number(num)]

def display_happy_numbers(start=1, end=500):
    happy_nums = find_happy_numbers(start, end)
    print(f"Happy Numbers from {start} to {end}:")
    print("-" * 50)
    for i, num in enumerate(happy_nums, 1):
        print(f"{num:4d}", end=" ")
        if i % 10 == 0:
            print()
    print(f"\n\nTotal happy numbers: {len(happy_nums)}")
    return happy_nums

def is_happy_number_detailed(n):
    seen = set()
    original = n
    steps = []
    while n != 1 and n not in seen:
        seen.add(n)
        steps.append(n)
        n = sum(int(digit) ** 2 for digit in str(n))
    steps.append(n)
    return n == 1, steps

if __name__ == "__main__":
    happy_numbers = display_happy_numbers(1, 500)

    known_happy = [1, 7, 10, 13, 19, 23, 28, 31]
    known_unhappy = [2, 3, 4, 5, 6, 8, 9, 11]

    print("\n" + "=" * 50)

```



```

if __name__ == "__main__":
    happy_numbers = display_happy_numbers(1, 500)

    known_happy = [1, 7, 10, 13, 19, 23, 28, 31]
    known_unhappy = [2, 3, 4, 5, 6, 8, 9, 11]

    print("\n" + "=" * 50)
    print("Validation with Known Numbers:")
    print("=" * 50)
    print("\nKnown Happy Numbers:")
    for num in known_happy:
        result = is_happy_number(num)
        status = "✓" if result else "✗"
        print(f"{status} {num}: {result}")

    print("\nKnown Unhappy Numbers:")
    for num in known_unhappy:
        result = is_happy_number(num)
        status = "✓" if not result else "✗"
        print(f"{status} {num}: {not result}")

    print("\n" + "=" * 50)
    print("Detailed Trace Examples:")
    print("=" * 50)
    test_cases = [7, 19, 2, 4]
    for num in test_cases:
        is_happy, steps = is_happy_number_detailed(num)
        status = "Happy" if is_happy else "Unhappy"
        print(f"\n{num} ({status}):")
        print(f"Steps: {' → '.join(map(str, steps))}")

```

OUTPUT:

Happy Numbers from 1 to 500:

```
-----
  1    7   10   13   19   23   28   31   32   44
 49   68   70   79   82   86   91   94   97  100
103  109  129  130  133  139  167  176  188  190
192  193  203  208  219  226  230  236  239  262
263  280  291  293  301  302  310  313  319  320
326  329  331  338  356  362  365  367  368  376
379  383  386  391  392  397  404  409  440  446
464  469  478  487  490  496
```

Total happy numbers: 76

=====

Validation with Known Numbers:

=====

Known Happy Numbers:

✓ 1: True
✓ 7: True
✓ 10: True
✓ 13: True
✓ 19: True
✓ 23: True
✓ 28: True
✓ 31: True

Known Unhappy Numbers:

✓ 2: True
✓ 3: True
✓ 4: True
✓ 5: True
✓ 6: True
✓ 8: True
✓ 9: True
✓ 11: True

=====

Detailed Trace Examples:

=====

7 (Happy):

Steps: 7 → 49 → 97 → 130 → 10 → 1

19 (Happy):

Steps: 19 → 82 → 68 → 100 → 1

2 (Unhappy):

Steps: 2 → 4 → 16 → 37 → 58 → 89 → 145 → 42 → 20 → 4

4 (Unhappy):

Steps: 4 → 16 → 37 → 58 → 89 → 145 → 42 → 20 → 4

Task Description #8 (Loops – Strong Numbers in a Range)

PROMPT:

Generate a function to display all Strong Numbers within a given range using loops, and regenerate an optimized version using precomputed factorials.

INPUT:

```
def factorial(n):
    result = 1
    for i in range(2, n + 1):
        result *= i
    return result

def precompute_factorials(max_digit=9):
    return {i: factorial(i) for i in range(max_digit + 1)}

def is_strong_number(n, factorial_dict):
    digit_sum = sum(factorial_dict[int(d)] for d in str(n))
    return digit_sum == n

def find_strong_numbers(start=1, end=100, factorial_dict=None):
    if factorial_dict is None:
        factorial_dict = precompute_factorials()
    return [num for num in range(start, end + 1) if is_strong_number(num, factorial_dict)]

def display_strong_numbers(start=1, end=100):
    factorial_dict = precompute_factorials()
    strong_nums = find_strong_numbers(start, end, factorial_dict)
    print(f"Strong Numbers from {start} to {end}:")
    for num in strong_nums:
        digits = [int(d) for d in str(num)]
        calc = " + ".join([f"{d}!" for d in digits])
        values = " + ".join([str(factorial_dict[d]) for d in digits])
        print(f"{num}: {calc} = {values} = {num}")
    print(f"Total: {len(strong_nums)}\n")
    return strong_nums

if __name__ == "__main__":
    print("=" * 60)
    print("STRONG NUMBERS FINDER")
    print("=" * 60)
    strong_nums = display_strong_numbers(1, 150)
    factorial_dict = precompute_factorials()
    print("Precomputed Factorials:", factorial_dict)
```

Output:

```
=====
STRONG NUMBERS FINDER
=====
Strong Numbers from 1 to 150:
1: 1! = 1 = 1
2: 2! = 2 = 2
145: 1! + 4! + 5! = 1 + 24 + 120 = 145
Total: 3

Precomputed Factorials: {0: 1, 1: 1, 2: 2, 3: 6, 4: 24, 5: 120, 6: 720, 7: 5040, 8: 40320, 9: 362880}
PS C:\Python_codes>
```

Task #9 – Few-Shot Prompting for Nested Dictionary Extraction

Objective

Use few-shot prompting (2–3 examples) to instruct the AI to create a function that parses a nested dictionary representing student information.

Requirements

- The function should extract and return:

- o Full Name
- o Branch
- o SGPA

PROMPT:

```
. Create a Python function that extracts full name, branch, and SGPA
from a nested dictionary representing student information.
```

INPUT:

```

def extract_student_info(student_dict):
    full_name = student_dict.get('name', {}).get('first', '') + ' ' + student_dict.get('name', {}).get('last', '')
    branch = student_dict.get('academic', {}).get('branch', 'N/A')
    sgpa = student_dict.get('academic', {}).get('sgpa', 'N/A')
    return full_name.strip(), branch, sgpa
def extract_multiple_students(students_list):
    return [extract_student_info(student) for student in students_list]
def display_student_info(student_dict):
    full_name, branch, sgpa = extract_student_info(student_dict)
    print(f"Full Name: {full_name}")
    print(f"Branch: {branch}")
    print(f"SGPA: {sgpa}")
def display_all_students(students_list):
    print("=" * 60)
    print("STUDENT INFORMATION")
    print("=" * 60)
    for i, student in enumerate(students_list, 1):
        print(f"\nStudent {i}:")
        print("-" * 30)
        display_student_info(student)
if __name__ == "__main__":
    students = [
        {
            'name': {'first': 'John', 'last': 'Smith'},
            'academic': {'branch': 'Computer Science', 'sgpa': 8.5}
        },
        {
            'name': {'first': 'Sarah', 'last': 'Johnson'},
            'academic': {'branch': 'Electronics', 'sgpa': 8.2}
        },
        {
            'name': {'first': 'Mike', 'last': 'Davis'},
            'academic': {'branch': 'Mechanical', 'sgpa': 7.9}
        },
        {
            'name': {'first': 'Emily', 'last': 'Wilson'},
            'academic': {'branch': 'Civil', 'sgpa': 8.7}
        }
    ]
    display_all_students(students)
    print("\n" + "=" * 60)
    print("EXTRACTED DATA:")
    print("=" * 60)
    extracted = extract_multiple_students(students)
    for i, (name, branch, sgpa) in enumerate(extracted, 1):
        print(f"{i}. {name} | {branch} | SGPA: {sgpa}")

```

Task Description #10 (Loops – Perfect Numbers in a Range)

Task: Generate a function using AI that displays all Perfect Numbers within a user-specified range (e.g., 1 to 1000).

PROMPT:

Generate a Python function that prints all Perfect Numbers in a user given range, and regenerate an optimized version by checking divisors only up to square root of the number.

INPUT:

```

def find_divisors_standard(n):
    divisors = []
    for i in range(1, n):
        if n % i == 0:
            divisors.append(i)
    return divisors

def is_perfect_number_standard(n):
    return sum(find_divisors_standard(n)) == n

def find_perfect_numbers_standard(start, end):
    return [num for num in range(start, end + 1) if is_perfect_number_standard(num)]

def find_divisors_optimized(n):
    divisors = [1]
    for i in range(2, int(n ** 0.5) + 1):
        if n % i == 0:
            divisors.append(i)
            if i != n // i:
                divisors.append(n // i)
    return divisors

def is_perfect_number_optimized(n):
    if n <= 1:
        return False
    return sum(find_divisors_optimized(n)) == n

def find_perfect_numbers_optimized(start, end):
    return [num for num in range(start, end + 1) if is_perfect_number_optimized(num)]

def display_perfect_numbers_standard(start, end):
    print("Perfect Numbers (Standard Method):")
    print("-" * 50)
    perfect = find_perfect_numbers_standard(start, end)
    for num in perfect:
        divisors = find_divisors_standard(num)
        print(f"{num}: {' + '.join(map(str, divisors))} = {sum(divisors)}")
    print(f"Total found: {len(perfect)}\n")
    return perfect

```

```

def find_perfect_numbers_optimized(start, end):
    return [num for num in range(start, end + 1) if is_perfect_number_optimized(num)]

def display_perfect_numbers_standard(start, end):
    print("Perfect Numbers (Standard Method):")
    print("-" * 50)
    perfect = find_perfect_numbers_standard(start, end)
    for num in perfect:
        divisors = find_divisors_standard(num)
        print(f"{num}: {' + '.join(map(str, divisors))} = {sum(divisors)}")
    print(f"Total found: {len(perfect)}\n")
    return perfect

def display_perfect_numbers_optimized(start, end):
    print("Perfect Numbers (Optimized - Square Root Method):")
    print("-" * 50)
    perfect = find_perfect_numbers_optimized(start, end)
    for num in perfect:
        divisors = sorted(find_divisors_optimized(num))
        print(f"{num}: {' + '.join(map(str, divisors))} = {sum(divisors)}")
    print(f"Total found: {len(perfect)}\n")
    return perfect

if __name__ == "__main__":
    start = int(input("Enter start of range: "))
    end = int(input("Enter end of range: "))
    print("\n" + "=" * 60)
    print("PERFECT NUMBERS FINDER")
    print("=" * 60 + "\n")
    standard = display_perfect_numbers_standard(start, end)
    print("=" * 60 + "\n")
    optimized = display_perfect_numbers_optimized(start, end)
    print("=" * 60)
    print(f"Both methods match: {standard == optimized}\n")

```

OUTPUT:

C:\python_codes> cd C:\python_codes\venv\scripts\python.exe &

Enter start of range: 1

Enter end of range: 100

=====

PERFECT NUMBERS FINDER

=====

Perfect Numbers (Standard Method):

6: $1 + 2 + 3 = 6$

28: $1 + 2 + 4 + 7 + 14 = 28$

Total found: 2

=====

Perfect Numbers (Optimized - Square Root Method):

6: $1 + 2 + 3 = 6$

28: $1 + 2 + 4 + 7 + 14 = 28$

Total found: 2

=====

Both methods match: True