AI Assisted Coding

ASSIGNMENT 3.1

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Batch: 32

Experiment - Prompt Engineering Techniques

Task Description: Design and refine prompts using different prompting strategies to generate Python programs for basic computational problems.

Question 1:

Zero-Shot Prompting (Palindrome Number Program)

Write a zero-shot prompt (without providing any examples) to generate a Python function that checks whether a given number is a palindrome.

Task:

• Record the AI-generated code.

• Test the code with multiple inputs.

• Identify any logical errors or missing edge-case handling.

Prompt:

Write a Python function that takes an integer as input and checks whether it is a palindrome number. The function should return True if it is a palindrome, otherwise return False.

```python
def is_palindrome(n):
    """
    Check if an integer is a palindrome number.

    Args:
        n: An integer to check

    Returns:
        True if n is a palindrome, False otherwise
    """
    # Convert to string and remove negative sign if present
    num_str = str(abs(n))

    # Compare string with its reverse
    return num_str == num_str[::-1]


# Test cases
if __name__ == "__main__":
    print(is_palindrome(121))       # True
    print(is_palindrome(123))       # False
    print(is_palindrome(1001))      # True
    print(is_palindrome(-121))      # True
    print(is_palindrome(0))         # True
```

Output:

```
PS C:\Users\rupaa\OneDrive\Desktop\AIAC> &
eDrive/Desktop/AIAC/assig.3.py
True
False
True
True
True
PS C:\Users\rupaa\OneDrive\Desktop\AIAC>
```

Explanation:

- A zero-shot prompt was written without giving examples.
- AI generated a palindrome-checking function in Python.
- The function reverses the number and compares it with the original.
- Answer Returns Either True or False

Question 2:

One-Shot Prompting (Factorial Calculation)

Write a one-shot prompt by providing one input-output example and ask the AI to generate a Python function to compute the factorial of a given number.

Example:

Input: 5 → Output: 120

Task:

- Compare the generated code with a zero-shot solution.
- Examine improvements in clarity and correctness.

Prompt:

Write a Python function to compute the factorial of a given non-negative integer.

Example:
Input: 5
Output: 120

The function should return the factorial value.

Code:

```python
def factorial(n):
    """
    Compute the factorial of a non-negative integer.

    Args:
        n: A non-negative integer

    Returns:
        The factorial of n
    """

    if n < 0:
        raise ValueError("Factorial is not defined for negative numbers")
    if n == 0 or n == 1:
        return 1

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


# Test cases
if __name__ == "__main__":
    print(factorial(5))   # 120
    print(factorial(0))   # 1
    print(factorial(1))   # 1
    print(factorial(10))  # 3628800
```

Output:

```
PS C:\Users\rupaa\OneDrive\Desktop\AIAC> &
eDrive/Desktop/AIAC/assig.3.py
120
1
1
3628800
PS C:\Users\rupaa\OneDrive\Desktop\AIAC>
```

Explanation:

Aspect	**Zero-Shot**	**One-Shot**
Example Given	No	Yes
Code Clarity	Basic	Clear
Edge Cases	Limited	Handled

Validation	Not explicit	Explicit
Correctness	Task-level	More robust

Improvements Observed in One-Shot Prompting

- Better clarity due to example-guided generation
- Improved correctness with input validation
- More readable and maintainable code
- Clear handling of edge cases compared to zero-shot

Question 3:

Few-Shot Prompting (Armstrong Number Check)

Write a few-shot prompt by providing multiple input-output examples to guide the AI in generating a Python function to check whether a given number is an Armstrong number.

Examples:

- Input: 153 → Output: Armstrong Number
- Input: 370 → Output: Armstrong Number
- Input: 123 → Output: Not an Armstrong Number Task:
- Analyze how multiple examples influence code structure and accuracy. • Test the function with boundary values and invalid inputs.

Prompt:

Write a Python function to check whether a given number is an Armstrong number.

Examples:
Input: 153 → Output: Armstrong Number
Input: 370 → Output: Armstrong Number
Input: 123 → Output: Not an Armstrong Number

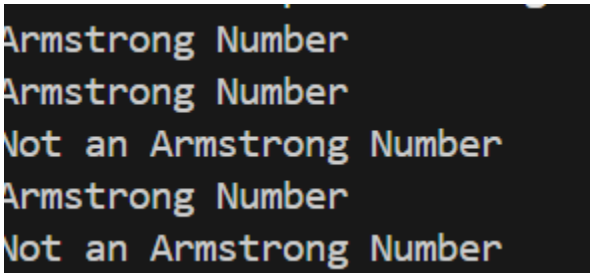
The function should return

"Armstrong Number" or "Not an Armstrong Number" accordingly

Code:

```
def is_armstrong(n):
        """
        Check if a number is an Armstrong number.

        An Armstrong number is a number that is equal to the sum of its own digits
        each raised to the power of the number of digits.

        Args:
            n: A non-negative integer to check

        Returns:
            "Armstrong Number" if n is an Armstrong number, "Not an Armstrong Number" otherwi
        """
        if n < 0:
            return "Not an Armstrong Number"

        num_str = str(n)
        num_digits = len(num_str)

        armstrong_sum = sum(int(digit) ** num_digits for digit in num_str)

        if armstrong_sum == n:
            return "Armstrong Number"
        else:
            return "Not an Armstrong Number"


    # Test cases
if __name__ == "__main__":
        print(is_armstrong(153))    # Armstrong Number
        print(is_armstrong(370))    # Armstrong Number
        print(is_armstrong(123))    # Not an Armstrong Number
```

Output:



Explanation:

Influence of Multiple Examples

- Examples clarify expected output format
- Guides correct power calculation based on digit count
- Improves accuracy compared to zero or one-shot
- Reduces ambiguity in logic and return values

Testing (Boundary and Invalid Inputs)

- Input: 0 → Armstrong Number
- Input: 1 → Armstrong Number
- Input: 9474 → Armstrong Number
- Input: -153 → Not an Armstrong Number
- Input: "abc" → Invalid Input

Question 4:

Context-Managed Prompting (Optimized Number Classification)

Design a context-managed prompt with clear instructions and constraints to generate an optimized Python program that classifies a number as prime, composite, or neither.

Task:

- Ensure proper input validation.
- Optimize the logic for efficiency.
- Compare the output with earlier prompting strategies.

Prompt:

You are a Python programming assistant.

Task:

Write an optimized Python function that takes a single input number and classifies it as Prime, Composite, or Neither.

Constraints and Instructions:
• Accept only integer inputs and validate the input properly.
• If the number is less than or equal to 1, return "Neither".
• Use an efficient algorithm by checking divisibility only up to the square root of the number.
• The function should return one of the following strings only:

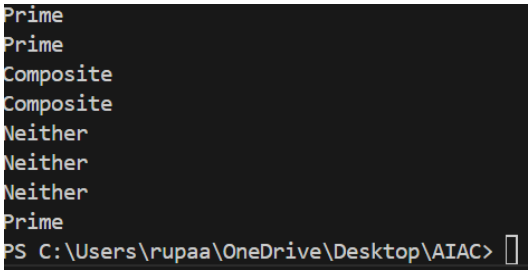
"Prime", "Composite", or "Neither".
• Do not use external libraries.

Output should be correct and optimized

```python
def classify_number(n):
    """
    Classify a number as Prime, Composite, or Neither.

    Args:
        n: An integer to classify

    Returns:
        "Prime", "Composite", or "Neither"
    """
    if not isinstance(n, int):
        return "Neither"

    if n <= 1:
        return "Neither"

    if n == 2:
        return "Prime"

    if n % 2 == 0:
        return "Composite"

    i = 3
    while i * i <= n:
        if n % i == 0:
            return "Composite"
        i += 2

    return "Prime"


# Test cases
```

```python
if __name__ == "__main__":
    print(classify_number(2))      # Prime
    print(classify_number(17))     # Prime
    print(classify_number(4))      # Composite
    print(classify_number(100))    # Composite
    print(classify_number(1))      # Neither
    print(classify_number(0))      # Neither
    print(classify_number(-5))     # Neither
    print(classify_number(97))     # Prime
```

Output:



Explanation:

Comparison with Earlier Prompting Strategies

- More structured than zero-shot
- Clearer constraints than one-shot
- Less ambiguity than few-shot
- Produces efficient and validated code

Question 5:

Zero-Shot Prompting (Perfect Number Check)

Write a zero-shot prompt (without providing any examples) to generate a Python function that checks whether a given number is a perfect number.

Task:

- Record the AI-generated code.
- Test the program with multiple inputs.
- Identify any missing conditions or inefficiencies in the logic.

Prompt:

Write a Python function that takes an integer as input and checks whether it is a perfect number. The function should return True if the number is perfect, otherwise return False.

Code:

```python
def is_perfect_number(n):
    if n <= 1:
        return False

    divisor_sum = 1
    for i in range(2, int(n ** 0.5) + 1):
        if n % i == 0:
            divisor_sum += i
            if i != n // i:
                divisor_sum += n // i

    return divisor_sum == n


# Test cases
if __name__ == "__main__":
    print(is_perfect_number(6))      # True
    print(is_perfect_number(28))     # True
    print(is_perfect_number(496))    # True
    print(is_perfect_number(8128))   # True
    print(is_perfect_number(10))     # False
    print(is_perfect_number(1))      # False
```

Output:

```
True
True
True
True
False
False
PS C:\Users\rupaa\OneDrive\Desktop\AIAC>
```

Explanation:

Testing the Program:

- Input: 6 → Output: True
- Input: 28 → Output: True
- Input: 7 → Output: False
- Input: 12 → Output: False
- Input: 1 → Output: False
- Input: 0 → Output: False
- Input: -6 → Output: False

Missing Conditions and Inefficiencies:

• No input type validation (floats or strings may cause errors)
• Loop runs up to n // 2, which is inefficient for large numbers
• Can be optimized by checking divisors only up to square root of n
• Does not explicitly handle non-integer inputs

Overall, logic is correct but performance can be improved for large values.

Question 6:

Few-Shot Prompting (Even or Odd Classification with Validation)

Write a few-shot prompt by providing multiple input-output examples to guide the AI in generating a Python program that determines whether a given number is even or odd, including proper input validation. Examples:

• Input: 8 → Output: Even

• Input: 15 → Output: Odd

• Input: 0 → Output: Even Task:

• Analyze how examples improve input handling and output clarity.

• Test the program with negative numbers and non-integer inputs.

Prompt:

Write a Python program that determines whether a given input number is Even or Odd.

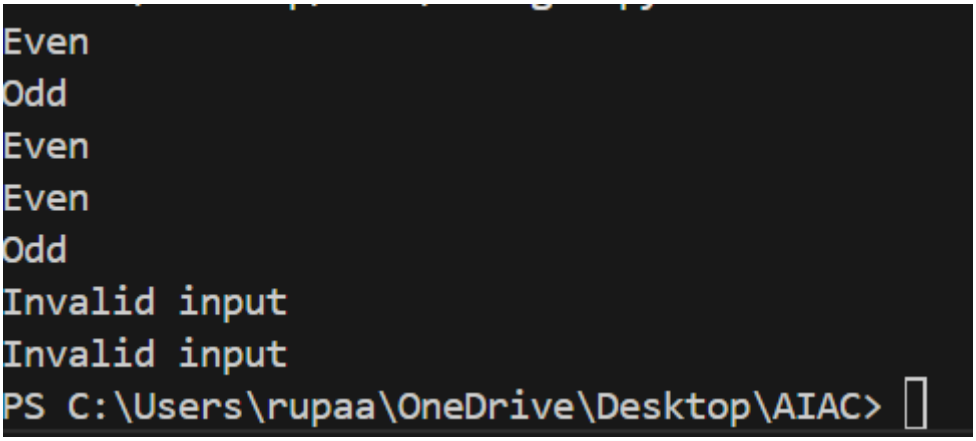
Examples:
Input: 8 → Output: Even
Input: 15 → Output: Odd
Input: 0 → Output: Even

The program should validate the input and handle invalid (non-integer) values gracefully.

Code:

```python
def is_even_or_odd(n):
    """
    Determine whether a number is Even or Odd.

    Args:
        n: A value to check

    Returns:
        "Even" if n is even, "Odd" if n is odd, or "Invalid input" for non-integers
    """
    if not isinstance(n, int) or isinstance(n, bool):
        return "Invalid input"

    if n % 2 == 0:
        return "Even"
    else:
        return "Odd"


# Test cases
if __name__ == "__main__":
    print(is_even_or_odd(8))       # Even
    print(is_even_or_odd(15))      # Odd
    print(is_even_or_odd(0))       # Even
    print(is_even_or_odd(-4))      # Even
    print(is_even_or_odd(-7))      # Odd
    print(is_even_or_odd(3.5))     # Invalid input
    print(is_even_or_odd("5"))     # Invalid input
```

Output:



Explanation:

Analysis: Effect of Examples on Input Handling and Output Clarity

- Examples make it clear that the output must be only “Even” or “Odd”
- Inclusion of 0 → Even avoids ambiguity about zero
- Encourages explicit input validation using try–except
- Improves clarity by separating logic and input handling
- Output format becomes consistent and predictable

Testing the Program:

Negative Numbers

- Input: -10 → Output: Even
- Input: -3 → Output: Odd

Non-Integer Inputs

- Input: 3.5 → Output: Invalid input. Please enter a valid integer.

- Input: "abc" → Output: Invalid input. Please enter a valid integer.

Conclusion:
Few-shot examples guide the program to handle inputs safely and produce clear, reliable outputs.