AI ASSISTANT CODING
LAB-3.1

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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 Used :

Write a Python function that checks whether a given integer number is a palindrome.
The function should return True if the number reads the same forward and backward,
otherwise return False.

AI-Refactored Code :

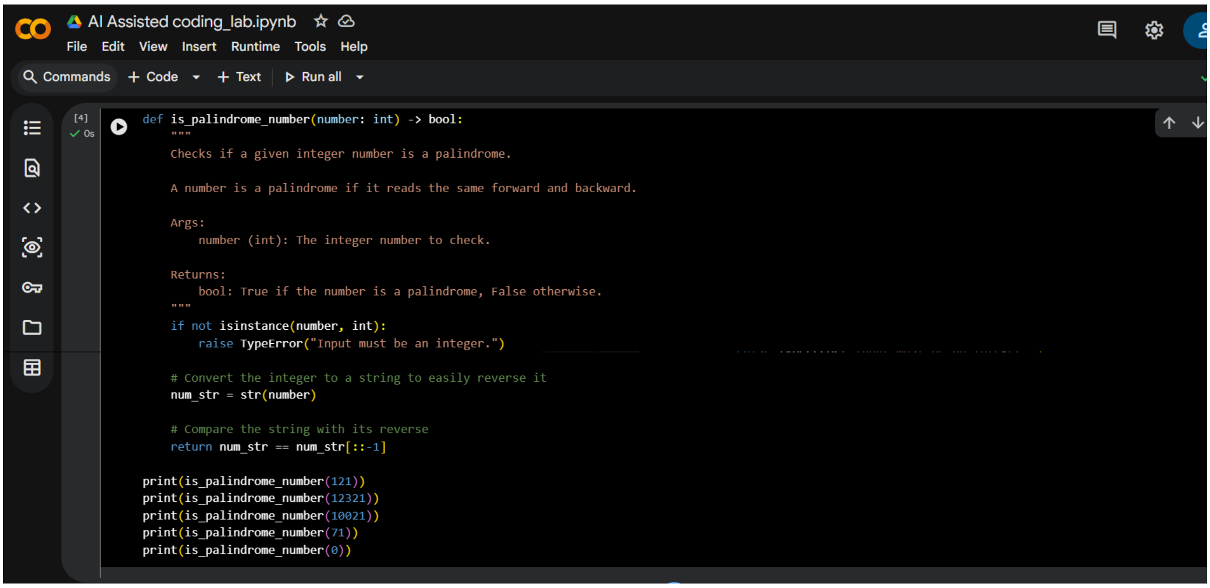
```
def is_palindrome_number(number: int) -> bool:
    """
    Checks if a given integer number is a palindrome.
    A number is a palindrome if it reads the same forward and backward.
    Args:
        number (int): The integer number to check.
```

```
Returns:
    bool: True if the number is a palindrome, False otherwise.
"""
if not isinstance(number, int):
    raise TypeError("Input must be an integer.")

# Convert the integer to a string to easily reverse it
num_str = str(number)

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

print(is_palindrome_number(121))
print(is_palindrome_number(12321))
print(is_palindrome_number(10021))
print(is_palindrome_number(71))
print(is_palindrome_number(0))
```



```python
    # Compare the string with its reve
    return num_str == num_str[::-1]

print(is_palindrome_number(121))
print(is_palindrome_number(12321))
print(is_palindrome_number(10021))
print(is_palindrome_number(71))
print(is_palindrome_number(0))
```

```
True
True
False
False
True
```

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 Used :

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

CODE:

```python
def factorial(n: int) -> int:
    """
    Computes the factorial of a given non-negative integer.

    Args:
        n (int): The non-negative integer for which to compute the factorial.
```

```
    Returns:
        int: The factorial of n.

    Raises:
        ValueError: If n is a negative integer.
        TypeError: If n is not an integer.
    """
    if not isinstance(n, int):
        raise TypeError("Input must be an integer.")
    if n < 0:
        raise ValueError("Factorial is not defined for negative numbers.")
    if n == 0:
        return 1
    else:
        result = 1
        for i in range(1, n + 1):
            result *= i
        return result

print(factorial(5))
print(factorial(10))
print(factorial(0))
```

```
def factorial(n: int) -> int:
    """
    Computes the factorial of a given non-negative integer.

    Args:
        n (int): The non-negative integer for which to compute the factorial.

    Returns:
        int: The factorial of n.

    Raises:
        ValueError: If n is a negative integer.
        TypeError: If n is not an integer.
    """
    if not isinstance(n, int):
        raise TypeError("Input must be an integer.")
    if n < 0:
        raise ValueError("Factorial is not defined for negative numbers.")
    if n == 0:
        return 1
    else:
        result = 1
        for i in range(1, n + 1):
            result *= i
        return result
```

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.

Prompts Used :

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

CODE:

```
def is_armstrong_number(number: int) -> bool:
  """
  Checks if a given integer number is an Armstrong number.
  An Armstrong number is a number that is the sum of its own digits
  each raised to the power of the number of digits.
  Args:
    number (int): The integer number to check.
  Returns:
    bool: True if the number is an Armstrong number, False otherwise.
  Raises:
    TypeError: If the input is not an integer.
    ValueError: If the input is a negative integer (Armstrong numbers are typically defined for
positive integers).
  """
  if not isinstance(number, int):
    raise TypeError("Input must be an integer.")
  if number < 0:
    raise ValueError("Armstrong numbers are typically defined for non-negative integers.")

  # Convert the number to a string to easily access its digits and count them
  num_str = str(number)
  num_digits = len(num_str)

  sum_of_powers = 0
  for digit_char in num_str:
    digit = int(digit_char)
    sum_of_powers += digit ** num_digits
```

    return sum_of_powers == number

print(is_armstrong_number(153))

print(is_armstrong_number(370))

print(is_armstrong_number(371))

print(is_armstrong_number(407))

print(is_armstrong_number(1634))

print(is_armstrong_number(8208))

print(is_armstrong_number(9474))

```python
def is_armstrong_number(number: int) -> bool:
    """
    Checks if a given integer number is an Armstrong number.

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

    Args:
        number (int): The integer number to check.

    Returns:
        bool: True if the number is an Armstrong number, False otherwise.

    Raises:
        TypeError: If the input is not an integer.
        ValueError: If the input is a negative integer (Armstrong numbers are typically defined for positive integers).
    """
    if not isinstance(number, int):
        raise TypeError("Input must be an integer.")
    if number < 0:
        raise ValueError("Armstrong numbers are typically defined for non-negative integers.")

    # Convert the number to a string to easily access its digits and count them
    num_str = str(number)
    num_digits = len(num_str)
```

```python
    num_digits = len(num_str)

    sum_of_powers = 0
    for digit_char in num_str:
        digit = int(digit_char)
        sum_of_powers += digit ** num_digits

    return sum_of_powers == number
print(is_armstrong_number(153))
print(is_armstrong_number(370))
print(is_armstrong_number(371))
print(is_armstrong_number(407))
print(is_armstrong_number(1634))
print(is_armstrong_number(8208))
print(is_armstrong_number(9474))
```

```
True
True
True
True
True
True
True
```

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.

Prompt:

You are an expert Python developer writing optimized and readable code.

Task: Write a Python program that classifies a given integer number as **Prime**, **Composite**, or **Neither**.

Rules & Constraints:

- If the number is less than or equal to 1, classify it as **Neither**.
- A **Prime** number has exactly two distinct positive divisors.
- A **Composite** number has more than two positive divisors.
- Use an optimized approach by checking divisibility only up to √n.
- The program must handle invalid inputs gracefully.
- Output must be one of the following strings only: "Prime", "Composite", or "Neither".
- Write clean, efficient, and well-commented Python code.

CODE:

```
def classify_number(n):
    if not isinstance(n, int):
        return "Neither"

    if n <= 1:
        return "Neither"

    for i in range(2, int(n ** 0.5) + 1):
        if n % i == 0:
            return "Composite"

    return "Prime"
```

```python
def classify_number(n):
    if not isinstance(n, int):
        return "Neither"

    if n <= 1:
        return "Neither"

    for i in range(2, int(n ** 0.5) + 1):
        if n % i == 0:
            return "Composite"

    return "Prime"
print(classify_number(7))
print(classify_number(10))
print(classify_number(17))
print(classify_number(1))
```

```
Prime
Composite
Prime
Neither
```

Conclusion :

This experiment demonstrated how different prompting techniques influence AI-generated code quality. Zero-shot prompting produced basic solutions, while one-shot and few-shot prompting improved clarity and accuracy through examples. Context-managed prompting delivered the most optimized and reliable results by clearly defining constraints and expectations. Overall, effective prompt design significantly enhances the correctness, efficiency, and robustness of AI-assisted coding.