

AI ASSISTED CODING

ASSIGNMENT - 3.1

ROLL NO. 2303A510J0

Question 1: Zero-Shot Prompting (Palindrome Number Program)

Prompt:

Write a Python function that checks whether a given number is a palindrome.

The screenshot shows a dark-themed interface for the Gemini AI. At the top, it says "Gemini". On the right side, there are three icons: a left arrow, a vertical ellipsis, and a close button (X). The main text area starts with a blue circular icon containing a white letter "C", followed by the prompt: "Write a Python function that checks whether a given number is a palindrome". Below this, a blue diamond icon contains the response: "Sure, here's a Python function to check if a given number is a palindrome, along with an explanation and an example." The response continues with: "The `is_palindrome` function works as expected. Here are the results for the example numbers:" followed by a bulleted list of four items. At the bottom of the main text area, there are three blue rounded rectangular buttons with white text: "Modify `is_palindrome` to consider absolute value for negative numbers", "Write a function to find the next palindrome after a given number", and "Add more test cases for the `is_palindrome` function". Below these buttons is a large input field with the placeholder text "What can I help you build?". At the bottom right of the input field, there is a "Gemini 2.5 Flash" button with a dropdown arrow and a right-pointing arrow. At the very bottom of the screen, there is a footer bar with the text "Gemini can make mistakes so double-check it and use code with caution. [Learn more](#)". On the left side of the footer bar is a small plus sign icon. On the right side, there are two small icons: a checkmark and a square with horizontal lines, followed by the text "12:48 PM" and "Python 3".

Code:

```
def is_palindrome(number):
    """
    Checks if a given number is a palindrome.

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

    Returns:
        bool: True if the number is a palindrome, False otherwise.
    """

    # Convert the number to a string
    num_str = str(number)

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

# Example usage:
print(f"Is 121 a palindrome? {is_palindrome(121)}")
print(f"Is 123 a palindrome? {is_palindrome(123)}")
print(f"Is 1221 a palindrome? {is_palindrome(1221)}")
print(f"Is -121 a palindrome? {is_palindrome(-121)}")
```

Output:

```
... Is 121 a palindrome? True
      Is 123 a palindrome? False
      Is 1221 a palindrome? True
      Is -121 a palindrome? False
```

Explanation:

Code uses type casting and then reverse the string to compare and check for palindrome

Analysis (Errors & Edge Cases)

Aspect	Observation
Logic	Correct for positive integers

Negative numbers	-121 → False (acceptable, but not explicitly handled)
Input validation	Missing (floats, strings not handled)
Efficiency	Efficient for small numbers

Conclusion:

Zero-shot prompting produces short and correct code, but lacks validation and explicit constraints.

Question 2: One-Shot Prompting (Factorial Calculation)

Prompt:

Write a Python function to calculate the factorial of a number.

Example: Input: 5 gives Output: 120

Code:

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

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

    Returns:
        int: The factorial of n.

    Raises:
        ValueError: If n is a negative integer.
    """
    if not isinstance(n, int) or n < 0:
        raise ValueError("n must be a non-negative integer")
    result = 1
    for i in range(1, n + 1):
        result *= i
    return result
```

```

        raise ValueError("Factorial is defined only for non-negative
integers.")

    if n == 0:
        return 1

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

# Example usage:
print(f"Factorial of 0: {factorial(0)}")
print(f"Factorial of 1: {factorial(1)}")
print(f"Factorial of 5: {factorial(5)}")
print(f"Factorial of 7: {factorial(7)}")

# Example with a negative number (will raise an error)
try:
    print(f"Factorial of -3: {factorial(-3)}")
except ValueError as e:
    print(f"Error: {e}")

```

Output:

```

" Factorial of 0: 1
Factorial of 1: 1
Factorial of 5: 120
Factorial of 7: 5040
Error: Factorial is defined only for non-negative integers.

```

Explanation:

This function calculates the factorial of a number using an iterative approach.

It first validates the input, ensuring that `n` is a non-negative integer; otherwise, it raises a `ValueError`.

If `n` is `0`, it returns `1` (by definition of factorial).

For positive integers, it multiplies numbers from `1` to `n` and returns the final result.

Comparison: Zero-Shot vs One-Shot

Feature	Zero-Shot	One-Shot
Input validation	No	Yes
Clarity	Medium	High
Edge cases	Missing	Handled
Readability	Basic	Improved

Conclusion:

Providing one example improves correctness, validation, and clarity.

Question 3: Few-Shot Prompting (Armstrong Number Check)

Prompt:

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

Use these examples as guidance:

- 153 → Armstrong Number
- 370 → Armstrong Number
- 123 → Not an Armstrong Number

The function should validate input (non-negative integers only) and, after implementation, test the function with boundary values (0, 1) and invalid inputs (negative numbers, non-integers), displaying the results.

Gemini

C "Write a Python function to check whether a number is an Armstrong number. Use these examples as guidance: • 153 → Armstrong Number • 370 → Armstrong Number • 123 → Not an Armstrong Number The function should validate input (non-negative integers only) and, after implementation, test the function with boundary values (0, 1) and invalid inputs (negative numbers, non-integers), displaying the results.

◆ Certainly! I'll create a Python function to check for Armstrong numbers, including input validation and comprehensive testing, and then demonstrate its usage.

The `is_armstrong` function has been executed successfully, and

[Find Armstrong numbers between 1 and 1000](#)

[Explain the logic of the `is_armstrong` function](#)

[Write a function to find all Armstrong numbers up to a given limit](#)

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+

Gemini 2.5 Flash ▾ ➤

Gemini can make mistakes so double-check it and use code with caution. [Learn more](#)

✓ 2:08PM Python 3

Code:

```
def is_armstrong(number):  
    """  
  
    Checks if a given 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 to check.  
  
    Returns:  
        bool: True if the number is an Armstrong number, False otherwise.  
  
    Raises:  
        ValueError: If the input is not a non-negative integer.  
    """  
  
    if not isinstance(number, int) or number < 0:  
        raise ValueError("Input must be a non-negative integer.")  
  
    # Special case for 0 and single-digit numbers  
    if number < 10:  
        return True
```

```
num_str = str(number)

num_digits = len(num_str)

armstrong_sum = 0


for digit_char in num_str:

    digit = int(digit_char)

    armstrong_sum += digit ** num_digits


return armstrong_sum == number


# Test cases provided by the user

print(f"Is 153 an Armstrong number? {is_armstrong(153)}") # Expected: True

print(f"Is 370 an Armstrong number? {is_armstrong(370)}") # Expected: True

print(f"Is 123 an Armstrong number? {is_armstrong(123)}") # Expected:
False


# Test with boundary values

print(f"Is 0 an Armstrong number? {is_armstrong(0)}") # Expected: True

print(f"Is 1 an Armstrong number? {is_armstrong(1)}") # Expected: True

print(f"Is 9 an Armstrong number? {is_armstrong(9)}") # Expected: True

print(f"Is 10 an Armstrong number? {is_armstrong(10)}") # Expected: False


# Test with other known Armstrong numbers

print(f"Is 371 an Armstrong number? {is_armstrong(371)}") # Expected: True
```

```
print(f"Is 407 an Armstrong number? {is_armstrong(407)}") # Expected: True

# Test with invalid inputs

print("\nTesting with invalid inputs:")

try:

    print(f"Is -153 an Armstrong number? {is_armstrong(-153)}")

except ValueError as e:

    print(f"Error for -153: {e}")



try:

    print(f"Is 12.5 an Armstrong number? {is_armstrong(12.5)}")

except ValueError as e:

    print(f"Error for 12.5: {e}")



try:

    print(f"Is 'abc' an Armstrong number? {is_armstrong('abc')}")

except ValueError as e:

    print(f"Error for 'abc': {e}")
```

Output:

```
... Is 153 an Armstrong number? True
Is 370 an Armstrong number? True
Is 123 an Armstrong number? False
Is 0 an Armstrong number? True
Is 1 an Armstrong number? True
Is 9 an Armstrong number? True
Is 10 an Armstrong number? False
Is 371 an Armstrong number? True
Is 407 an Armstrong number? True

Testing with invalid inputs:
Error for -153: Input must be a non-negative integer.
Error for 12.5: Input must be a non-negative integer.
Error for 'abc': Input must be a non-negative integer.
```

Explanation:

The function checks whether a number is an Armstrong number after validating that the input is a non-negative integer.

It extracts each digit, raises it to the power of the total number of digits, and sums the results.

If this sum equals the original number, the function returns **True**; otherwise, it returns **False**.

Analysis: Effect of Multiple Examples

Providing multiple examples helps the AI correctly understand the Armstrong number formula.

It improves code accuracy, ensures proper digit-based computation, and leads to a clear and reliable implementation.

Question 4: Context-Managed Prompting (Optimized Number Classification)

Prompt:

Write an optimized Python program that classifies a given number as **Prime**, **Composite**, or **Neither**.

The program must validate input, handle numbers less than or equal to 1 correctly, and use an efficient prime-checking approach (checking divisibility only up to \sqrt{n}).

After implementation, test the program with valid inputs, boundary values, and invalid inputs, and display the results clearly.

The screenshot shows a dark-themed interface for the Gemini AI. At the top, it says "Gemini". Below that is a list of items:

- C Write an optimized Python program that classifies a given number as Prime, Composite, or Neither. The program must validate input, handle numbers less than or equal to 1 correctly, and use an efficient prime-checking approach (checking divisibility only up to \sqrt{n}). After implementation, test the program with valid inputs, boundary values, and invalid inputs, and display the results clearly.
- ◆ Okay, I will create an optimized Python program to classify a given number as Prime, Composite, or Neither. It will handle input validation, special cases for numbers less than or equal to 1, and use an efficient prime-checking method. I'll then include comprehensive tests for various scenarios.

Below the list are three buttons:

- Explain the 'classify_number' function
- Generate a list of prime numbers up to 1000
- Test the 'is_armstrong' function with a larger number

At the bottom left, there's a text input field with "What can I help you build?" and a plus sign button. On the right, it says "Gemini 2.5 Flash" with a dropdown arrow and a right-pointing arrow. At the very bottom, it says "Gemini can make mistakes so double-check it and use code with caution. [Learn more](#)".

Code:

```
import math

def classify_number(number):
    """
    Classifies a given number as Prime, Composite, or Neither.

    Args:

```

```
number (int): The integer to classify.

Returns:
    str: 'Prime', 'Composite', or 'Neither' based on the
classification.

Raises:
    ValueError: If the input is not an integer.

"""
if not isinstance(number, int):
    raise ValueError("Input must be an integer.")

if number <= 1:
    return "Neither"
elif number == 2:
    return "Prime"
elif number % 2 == 0:
    return "Composite"

# Check for divisibility from 3 up to sqrt(number) with a step of 2
# (only odd numbers need to be checked after 2)
for i in range(3, int(math.sqrt(number)) + 1, 2):
    if number % i == 0:
        return "Composite"
return "Prime"

# Test cases for classify_number function
print("--- Valid Inputs ---")
print(f"2 is: {classify_number(2)}")      # Expected: Prime
print(f"7 is: {classify_number(7)}")      # Expected: Prime
print(f"10 is: {classify_number(10)}")     # Expected: Composite
print(f"17 is: {classify_number(17)}")     # Expected: Prime
print(f"25 is: {classify_number(25)}")     # Expected: Composite
print(f"101 is: {classify_number(101)}")    # Expected: Prime
print(f"999 is: {classify_number(999)}")    # Expected: Composite

print("\n--- Boundary Values ---")
print(f"0 is: {classify_number(0)}")      # Expected: Neither
print(f"1 is: {classify_number(1)}")      # Expected: Neither
print(f"-5 is: {classify_number(-5)}")    # Expected: Neither
print(f"-1 is: {classify_number(-1)}")    # Expected: Neither
```

```

print("\n--- Invalid Inputs ---")
try:
    print(f"1.5 is: {classify_number(1.5)}")
except ValueError as e:
    print(f"Error for 1.5: {e}")

try:
    print(f"'abc' is: {classify_number('abc')}")
except ValueError as e:
    print(f"Error for 'abc': {e}")

try:
    print(f"None is: {classify_number(None)}")
except ValueError as e:
    print(f"Error for None: {e}")

```

Output:

```

... --- Valid Inputs ---
2 is: Prime
7 is: Prime
10 is: Composite
17 is: Prime
25 is: Composite
101 is: Prime
999 is: Composite

... --- Boundary Values ---
0 is: Neither
1 is: Neither
-5 is: Neither
-1 is: Neither

... --- Invalid Inputs ---
Error for 1.5: Input must be an integer.
Error for 'abc': Input must be an integer.
Error for None: Input must be an integer.

```

Explanation:

The function first validates that the input is an integer.

Numbers less than or equal to 1 are classified as **Neither**, while 2 is directly classified as **Prime**.

Even numbers greater than 2 are marked **Composite**.

For other numbers, divisibility is checked only up to \sqrt{n} and only for odd numbers, making the algorithm efficient.
If no divisor is found, the number is classified as **Prime**.

Comparison with Earlier Prompting Strategies

Compared to zero-shot and few-shot prompting, context-managed prompting produces **more optimized and structured output**.

Earlier strategies often lacked efficiency or complete validation, whereas this approach ensures **correct classification, input validation, and better performance**.

Overall, context-managed prompting results in **more reliable and production-quality code**.

Question 5: Zero-Shot Prompting (Perfect Number Check)

Prompt:

Write a Python function that checks whether a given number is a perfect number.

The function should return **True** if the number is perfect and **False** otherwise.

Gemini

C Write a Python function that checks whether a given number is a perfect number. The function should return True if the number is perfect and False otherwise.

◆ Certainly! I'll create a Python function to check for perfect numbers. First, I'll provide a brief explanation of perfect numbers, then implement the function, and finally, include test cases to demonstrate its usage and validate its behavior.

The `is_perfect_number` function has been successfully implemented and tested! The output clearly shows how it correctly identifies perfect numbers (like 6, 28, 496, 8128) and non-perfect numbers (like 10, 12, 7)

[Generate a list of Mersenne primes](#)

[Explain the relationship between Mersenne primes and perfect numbers](#)

[Add a function to find the next perfect number after a given input](#)

What can I help you build?

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✓ 2:22 PM Python 3

Code:

```
def is_perfect_number(number):
    """
    Checks if a given number is a perfect number.

    A perfect number is a positive integer that is equal to the sum of its
    proper positive divisors (divisors excluding the number itself).

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

    Returns:
        bool: True if the number is a perfect number, False otherwise.

    Raises:
        None
    """

    def sum_of_divisors(n):
        total = 1
        for i in range(2, n):
            if n % i == 0:
                total += i
        return total

    if sum_of_divisors(number) == number:
        return True
    else:
        return False
```

```

    ValueError: If the input is not a positive integer.

"""

if not isinstance(number, int) or number <= 0:
    raise ValueError("Input must be a positive integer.")

if number == 1:
    return False # 1 has no proper divisors, sum is 0, not 1

sum_of_divisors = 1 # Start with 1, as 1 is always a divisor
for i in range(2, int(number**0.5) + 1):
    if number % i == 0:
        sum_of_divisors += i
        if i * i != number:
            sum_of_divisors += number // i

return sum_of_divisors == number

# Example usage and test cases
print("--- Perfect Number Checks ---")
print(f"Is 6 a perfect number? {is_perfect_number(6)}")      # Expected:
True (1 + 2 + 3 = 6)
print(f"Is 28 a perfect number? {is_perfect_number(28)}")    # Expected:
True (1 + 2 + 4 + 7 + 14 = 28)
print(f"Is 496 a perfect number? {is_perfect_number(496)}")  # Expected:
True
print(f"Is 8128 a perfect number? {is_perfect_number(8128)}") # Expected:
True

print("\n--- Non-Perfect Number Checks ---")
print(f"Is 10 a perfect number? {is_perfect_number(10)}")    # Expected:
False (1 + 2 + 5 = 8)
print(f"Is 12 a perfect number? {is_perfect_number(12)}")    # Expected:
False (1 + 2 + 3 + 4 + 6 = 16)
print(f"Is 7 a perfect number? {is_perfect_number(7)}")      # Expected:
False (1)

print("\n--- Boundary and Invalid Inputs ---")
print(f"Is 1 a perfect number? {is_perfect_number(1)}")      # Expected:
False (as per definition)

```

```

try:
    print(f"Is 0 a perfect number? {is_perfect_number(0)}")
except ValueError as e:
    print(f"Error for 0: {e}")

try:
    print(f"Is -5 a perfect number? {is_perfect_number(-5)}")
except ValueError as e:
    print(f"Error for -5: {e}")

try:
    print(f"Is 12.5 a perfect number? {is_perfect_number(12.5)}")
except ValueError as e:
    print(f"Error for 12.5: {e}")

try:
    print(f"Is 'abc' a perfect number? {is_perfect_number('abc')}")
except ValueError as e:
    print(f"Error for 'abc': {e}")

```

Output:

```

▼ ... --- Perfect Number Checks ---
  Is 6 a perfect number? True
  Is 28 a perfect number? True
  Is 496 a perfect number? True
  Is 8128 a perfect number? True

  --- Non-Perfect Number Checks ---
  Is 10 a perfect number? False
  Is 12 a perfect number? False
  Is 7 a perfect number? False

  --- Boundary and Invalid Inputs ---
  Is 1 a perfect number? False
  Error for 0: Input must be a positive integer.
  Error for -5: Input must be a positive integer.
  Error for 12.5: Input must be a positive integer.
  Error for 'abc': Input must be a positive integer.

```

Explanation:

The function first checks whether the input is a positive integer, raising an error for invalid inputs.

It returns **False** for 1 since it is not a perfect number.

The function then calculates the sum of all proper divisors by checking divisors only up to \sqrt{n} , adding both the divisor and its pair when found.

Finally, it compares the sum of divisors with the original number to determine if it is perfect.

Missing Conditions or Inefficiencies in the Logic

- The code efficiently reduces time complexity by checking divisors only up to \sqrt{n} .
 - However, it does not stop early if the divisor sum exceeds the number, which could improve performance.
 - Large input values may still be computationally expensive due to iteration.
 - Apart from minor optimization opportunities, the logic correctly handles all required conditions.
-

Question 6: Few-Shot Prompting (Even or Odd Classification with Validation)

Prompt:

Write a Python program to determine whether a given number is Even or Odd.

Use the following examples as guidance:

- Input: 8 → Output: Even

- Input: 15 → Output: Odd
- Input: 0 → Output: Even

The program should validate input and handle negative numbers and non-integer inputs appropriately.

Gemini

C Write a Python program to determine whether a given number is Even or Odd. Use the following examples as guidance:

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

The program should validate input and handle negative numbers and non-integer inputs appropriately.

◆ Certainly! I'll create a Python program that checks whether a given number is Even or Odd. I will start by explaining the concept, then provide the function with input validation and handle various cases including negative numbers and zero, and finally, include comprehensive test cases.

The `is_even_or_odd` function has been successfully combined all implemented number checking functions into one program

Add more test cases for the `is_even_or_odd` function

Explain the concept of prime numbers in more detail

What can I help you build?

+ Gemini 2.5 Flash ➤

Gemini can make mistakes so double-check it and use code with caution. [Learn more](#)

Code:

```
def is_even_or_odd(number):
    """
    Determines if a given number is Even or Odd.

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

    Returns:
        bool: True if the number is Even, False otherwise.
    """
    return number % 2 == 0
```

```
    str: 'Even' if the number is even, 'Odd' if the number is odd.

Raises:
    ValueError: If the input is not an integer.
"""

if not isinstance(number, int):
    raise ValueError("Input must be an integer.")

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

# Example usage and test cases
print("--- Even/Odd Number Checks ---")
print(f"8 is: {is_even_or_odd(8)}"      # Expected: Even
print(f"15 is: {is_even_or_odd(15)}"     # Expected: Odd
print(f"0 is: {is_even_or_odd(0)}"       # Expected: Even
print(f"-2 is: {is_even_or_odd(-2)}"     # Expected: Even
print(f"-7 is: {is_even_or_odd(-7)}"     # Expected: Odd
print(f"100 is: {is_even_or_odd(100)}"   # Expected: Even
print(f"99 is: {is_even_or_odd(99)}"     # Expected: Odd

print("\n--- Invalid Inputs ---")
try:
    print(f"1.5 is: {is_even_or_odd(1.5)}")
except ValueError as e:
    print(f"Error for 1.5: {e}")

try:
    print(f"'abc' is: {is_even_or_odd('abc')}")
except ValueError as e:
    print(f"Error for 'abc': {e}")

try:
    print(f"None is: {is_even_or_odd(None)}")
except ValueError as e:
    print(f"Error for None: {e}")
```

Output:

```
[10] 0s
...     print(f"Error for None: {e}")
...
--- Even/Odd Number Checks ---
8 is: Even
15 is: Odd
0 is: Even
-2 is: Even
-7 is: Odd
100 is: Even
99 is: Odd

--- Invalid Inputs ---
Error for 1.5: Input must be an integer.
Error for 'abc': Input must be an integer.
Error for None: Input must be an integer.
```

Explanation:

The program first checks whether the input is an integer to ensure valid input.

It then uses the modulo operator to determine if the number is divisible by 2.

If divisible, the number is classified as Even; otherwise, it is classified as Odd.

Invalid inputs are handled gracefully using input validation.

Analysis: Effect of Examples

Providing multiple examples helps the AI clearly understand the expected behavior for different cases.

It improves input handling, ensures correct classification of 0 and negative numbers, and enhances output clarity.

Conclusion from this assignment:

Prompt design directly impacts the **accuracy and quality** of AI-generated code.

Zero-shot prompting gives basic solutions but may lack validation or optimization.

One-shot and few-shot prompting improve correctness, readability, and handling of edge cases.

Context-managed prompting produces **optimized, reliable, and fully validated programs**.

Well-structured prompts lead to **more efficient, robust, and production-ready code**.