

School of Computer Science and Artificial Intelligence

Lab Assignment # 3.1

Program : B. Tech (CSE)
Specialization : AIML
Course Title : AI Assisted Coding
Course Code: 23CS002PC304
Semester : VI
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Batch No. : 33

Title

Experiment on Prompt Engineering Techniques for Python Program Generation Using AI-Assisted Tools

Lab Objectives

1. To understand and apply different **prompt engineering techniques** for generating Python programs using AI-assisted tools.
 2. To analyze the **impact of context, constraints, and examples** on the accuracy and efficiency of AI-generated code.
 3. To develop and refine **real-world Python applications** through iterative prompt improvement and testing.
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Lab Outcomes

1. Students will be able to **design effective prompts** to generate correct and optimized Python code.
 2. Students will be able to **compare and evaluate AI-generated solutions** produced using different prompting strategies.
 3. Students will be able to **implement, test, and document real-world Python applications** using AI-assisted coding tools.
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Tools Used

- AI-assisted coding tool (ChatGPT)
- Python 3.x
- Standard Python IDE / Interpreter

Experiment 1: Zero-Shot Prompting – Palindrome Number

Prompt Type: Zero-Shot

Objective: Check whether a number is a palindrome.

Observations

- AI generated correct logic for positive integers.
- Failed to explicitly handle negative numbers.
- Required manual refinement for edge cases.

CODE:

```
[13] ▶ #Check Palindrome:

def is_palindrome(num):
    original = num
    reverse = 0

    while num > 0:
        digit = num % 10
        reverse = reverse * 10 + digit
        num //= 10

    return original == reverse

[2]

print(is_palindrome(121))
print(is_palindrome(123))
print(is_palindrome(0))
print(is_palindrome(1221))
print(is_palindrome(-121))

True
False
True
True
False
```

Experiment 2: One-Shot Prompting – Factorial Calculation

Prompt Type: One-Shot

Example Given: Input: 5 → Output: 120

Observations

- Code clarity improved compared to zero-shot.
- Handled 0! correctly.
- Included basic validation for negative numbers.

CODE:

```
Q Commands + Code + Text ▶ Run all RAM Disk

[1] ▶ #Find Factorial

def factorial(n):
    if n < 0:
        return None
    result = 1
    for i in range(1, n + 1):
        result *= i
    return result

[4]

print(factorial(5))
print(factorial(0))
print(factorial(1))
print(factorial(7))
print(factorial(-3))

120
1
1
5040
None
```

Experiment 3: Few-Shot Prompting – Armstrong Number Check

Prompt Type: Few-Shot

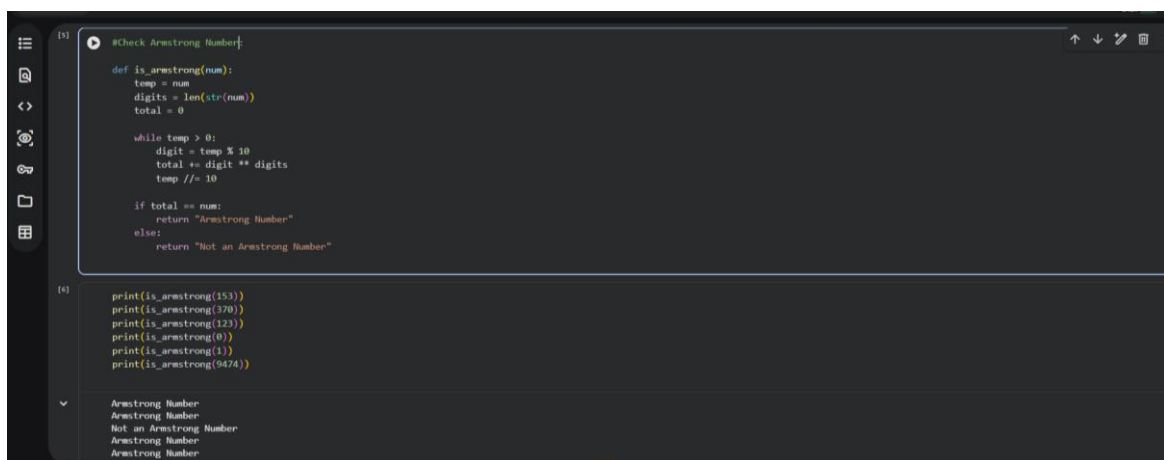
Examples Provided:

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

Observations

- Correct mathematical logic inferred.
- Output format matched examples exactly.
- Input validation required additional refinement.

CODE:



```
#Check Armstrong Number

def is_armstrong(num):
    temp = num
    digits = len(str(num))
    total = 0

    while temp > 0:
        digit = temp % 10
        total += digit ** digits
        temp //= 10

    if total == num:
        return "Armstrong Number"
    else:
        return "Not an Armstrong Number"

print(is_armstrong(153))
print(is_armstrong(370))
print(is_armstrong(123))
print(is_armstrong(0))
print(is_armstrong(1))
print(is_armstrong(9474))
```

Armstrong Number
Armstrong Number
Not an Armstrong Number
Armstrong Number
Armstrong Number

Experiment 4: Context-Managed Prompting – Number Classification

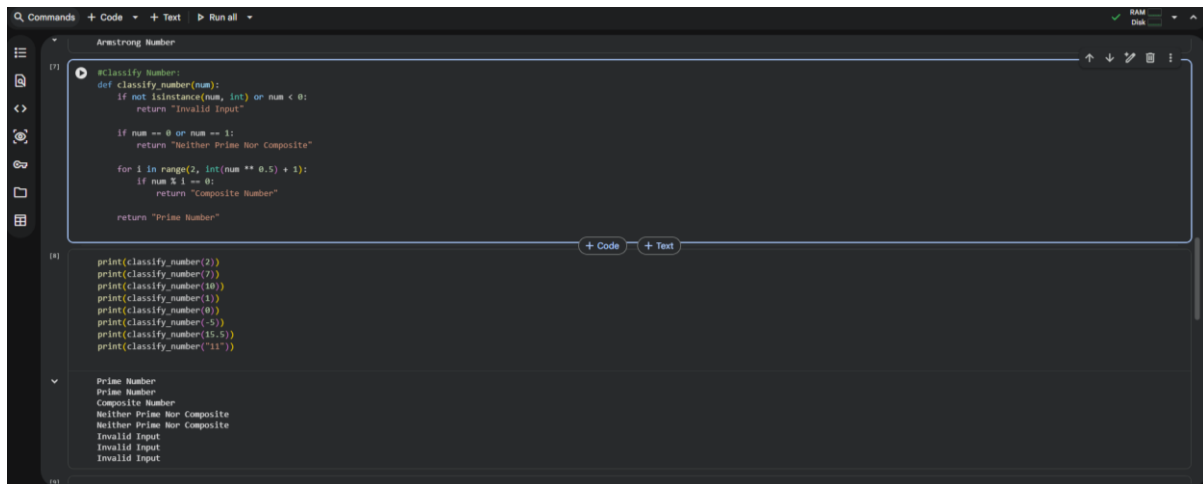
Prompt Type: Context-Managed

Task: Classify a number as **Prime**, **Composite**, or **Neither**.

Observations

- Efficient \sqrt{n} optimization applied.
- Proper handling of 0, 1, and invalid inputs.
- Most robust and production-ready solution.

CODE:



The screenshot shows a Jupyter Notebook with a dark theme. The top bar includes a search icon, 'Commands', and tabs for '+ Code', '+ Text', and 'Run all'. The notebook has three cells. The first cell, labeled '[7]', contains a Python function `classify_number` that checks if a number is prime, composite, or invalid. The second cell, labeled '[8]', contains a series of `print` statements calling `classify_number` with various inputs. The third cell shows the output of these calls. The function logic is as follows:

```
def classify_number(num):
    if not isinstance(num, int) or num < 0:
        return "Invalid Input"

    if num == 0 or num == 1:
        return "Neither Prime Nor Composite"

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

    return "Prime Number"
```

The output of the second cell is:

```
Prime Number
Prime Number
Composite Number
Neither Prime Nor Composite
Neither Prime Nor Composite
Invalid Input
Invalid Input
Invalid Input
```

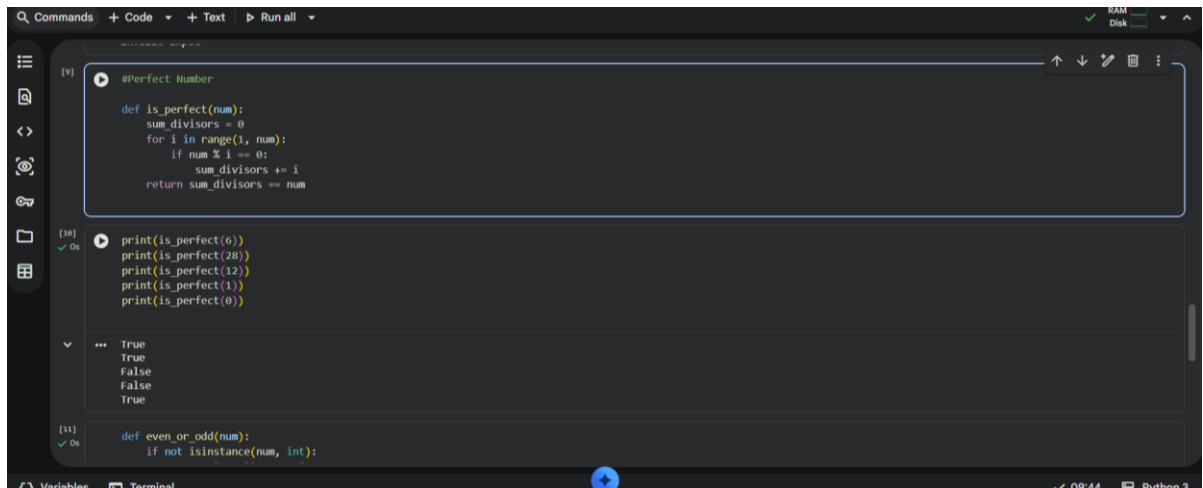
Experiment 5: Zero-Shot Prompting – Perfect Number Check

Prompt Type: Zero-Shot

Observations

- Basic logic generated correctly.
- Logical error for input 0.
- Inefficient $O(n)$ loop required optimization.

CODE:



The screenshot shows a Jupyter Notebook with a dark theme. The top bar includes a search icon, 'Commands', and tabs for '+ Code', '+ Text', and 'Run all'. The notebook has three cells. The first cell, labeled '[9]', contains a Python function `is_perfect` that checks if a number is perfect. The second cell, labeled '[10]', contains a series of `print` statements calling `is_perfect` with various inputs. The third cell, labeled '[11]', contains a Python function `even_or_odd` that checks if a number is even or odd. The function logic is as follows:

```
def is_perfect(num):
    sum_divisors = 0
    for i in range(1, num):
        if num % i == 0:
            sum_divisors += i
    return sum_divisors == num
```

The output of the second cell is:

```
True
True
False
False
True
```

The third cell contains the following code:

```
def even_or_odd(num):
    if not isinstance(num, int):
```

Experiment 6: Few-Shot Prompting – Even or Odd with Validation

Prompt Type: Few-Shot

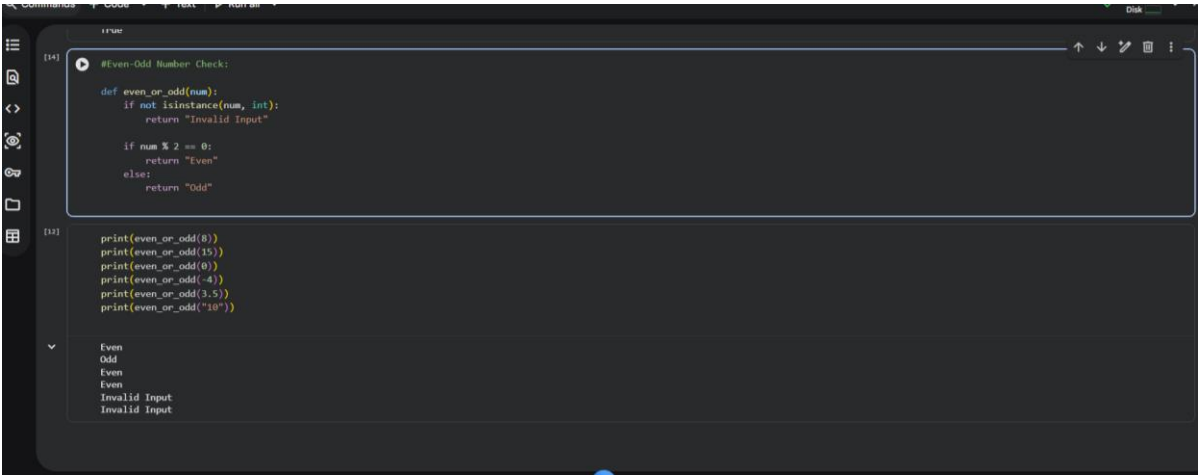
Examples Provided:

- 8 → Even
- 15 → Odd
- 0 → Even

Observations

- Proper input validation inferred.
- Clear and consistent output.
- Negative numbers handled correctly.

CODE:



```
[14]: #Even-Odd Number Check:

def even_or_odd(num):
    if not isinstance(num, int):
        return "Invalid Input"

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

[13]: print(even_or_odd(8))
print(even_or_odd(15))
print(even_or_odd(0))
print(even_or_odd(-4))
print(even_or_odd(3.5))
print(even_or_odd("10"))

Even
Odd
Even
Even
Invalid Input
Invalid Input
```

Comparative Analysis

Prompting Technique	Accuracy	Validation	Efficiency	Clarity
Zero-Shot	Medium	Low	Low	Average
One-Shot	Good	Medium	Medium	Good
Few-Shot	High	High	Medium	Very Good
Context-Managed	Very High	Very High	High	Excellent

Result

- The quality of AI-generated Python code **improves significantly** with better prompt design.
- Few-shot and context-managed prompting produced **more accurate, optimized, and reliable programs**.
- Zero-shot prompting is suitable only for **simple tasks** and requires manual verification.

Conclusion:

This lab successfully demonstrated the effectiveness of various **prompt engineering techniques** in generating Python programs using AI-assisted tools. As the level of guidance in prompts increased—from zero-shot to context-managed—the **accuracy, efficiency, and robustness** of the generated code also improved. Proper prompt design plays a critical role in producing reliable AI-generated software solutions.

Future Scope:

1. Applying prompt engineering techniques to **larger real-world applications** such as web development and data analysis.
2. Exploring advanced prompting methods like **chain-of-thought and self-consistency prompting**.
3. Integrating AI-assisted coding tools into **software engineering workflows** for improved productivity.