

School of Computer Science and Artificial Intelligence

Lab Assignment # 3.2

Program : B. Tech (CSE)
Specialization : AIML
Course Title : AI Assisted
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Lab 3: Prompt Engineering – Improving Prompts and Context Management

Lab Objectives

- To understand how **prompt structure and wording** influence AI-generated code.
 - To explore how **context (comments, function names, and examples)** helps AI generate more relevant output.
 - To evaluate the **quality, accuracy, and structure** of AI-generated code based on prompt clarity.
 - To develop **effective prompting strategies** for AI-assisted programming.
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Lab Outcomes (LOs)

After completing this lab, students will be able to:

- Generate Python code using **Google Gemini** in **Google Colab**.
 - Analyze the effectiveness of **code explanations and suggestions** provided by Gemini.
 - Set up and use **Cursor AI** for AI-powered coding assistance.
 - Evaluate and refactor Python code using **Cursor AI features**.
 - Compare **AI tool behavior and code quality** across different platforms.
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Tools Used

- Google Gemini (Google Colab)
 - Cursor AI
 - Python 3.x
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Task Description – 1

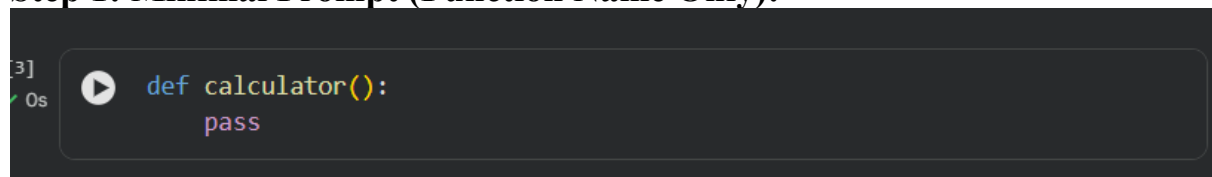
Progressive Prompting for Calculator Design

Design a simple calculator program using **progressive prompt enhancement**:

1. Start with **only the function name**
2. Add **comments describing functionality**
3. Add **usage examples**

Analyze how each step improves the AI-generated code.

Step 1: Minimal Prompt (Function Name Only):

A screenshot of a code editor with a dark background. On the left, there is a small icon of a play button and the text '0s'. The main area of the editor contains the text 'def calculator():' on the first line and 'pass' on the second line, both in a light blue font. The text is highlighted with a light blue selection box.

Observation

- AI lacks context
- No logic, parameters, or functionality

- Output is incomplete and unusable

Step 2: Prompt with Comments (Added Context):

```
[4]
✓ Os
def calculator(a, b, operator):
    if operator == '+':
        return a + b
    elif operator == '-':
        return a - b
    elif operator == '*':
        return a * b
    elif operator == '/':
        return a / b
    else:
        return "Invalid operator"
```

Observation

- Correct logic implemented
- Parameters inferred correctly
- No input validation (division by zero not handled)

Step 3: Prompt with Comments + Usage Examples:

```
5]
Os
def calculator(a, b, operator):
    if not isinstance(a, (int, float)) or not isinstance(b, (int, float)):
        return "Invalid input"

    if operator == '+':
        return a + b
    elif operator == '-':
        return a - b
    elif operator == '*':
        return a * b
    elif operator == '/':
        if b == 0:
            return "Cannot divide by zero"
        return a / b
    else:
        return "Invalid operator"
```

Observation

- Input validation added
- Division by zero handled
- Code is robust, readable, and user-safe
- Output format matches examples

Expected Output – Comparison Analysis
Comparison of AI-Generated Calculator Code

Prompt Level	Logic Quality	Validation	Robustness	Code Clarity
Function Name Only	Very Poor	None	None	Very Low
With Comments	Good	Partial	Limited	Good
Comments + Examples	Excellent	Full	High	Very High

Task Description – 2:

Refining Prompts for Sorting Logic

Objective:

To observe how refining a vague prompt into a clear, constrained prompt improves the correctness and efficiency of an AI-generated sorting function for student marks.

Step 1: Vague Prompt

```
[6]
✓ 0s
def sort_marks(marks):
    return sorted(marks)
```

Observation

- Sorting order not specified (ascending or descending)
- No validation of input type
- Assumes marks are always valid

Step 2: Refined Prompt with Constraints

```
[7]
✓ 0s
def sort_marks(marks):
    if not all(isinstance(m, (int, float)) for m in marks):
        return "Invalid input"

    return sorted(marks)
```

Observation

- Sorting order clearly defined
- Input validation added
- Logic is more reliable

Step 3: Fully Refined Prompt

```
[8]
✓ 0s
def sort_marks(marks):
    if not isinstance(marks, list) or not all(isinstance(m, (int, float))
        return "Invalid input"

    return sorted(marks, reverse=True)
```

Expected Output – 2 (Analysis)

Prompt Clarity	Sorting Accuracy	Validation	Efficiency
Vague	Low	None	Medium
Refined	High	Partial	High
Fully Refined	Very High	Full	High

Task Description – 3

Few-Shot Prompting for Prime Number Validation

Objective:

To analyze how providing multiple input-output examples improves correctness and edge-case handling.

Few-Shot Prompt:

```
[9]
✓ Os
def is_prime(num):
    if not isinstance(num, int) or num <= 1:
        return "Not Prime"

    for i in range(2, int(num ** 0.5) + 1):
        if num % i == 0:
            return "Not Prime"

    return "Prime"
```

```
[10]
✓ Os
▶ print(is_prime(2))
  print(is_prime(9))
  print(is_prime(17))
  print(is_prime(1))
  print(is_prime(-5))
```

```
... Prime
  Not Prime
  Prime
  Not Prime
  Not Prime
```

Expected Output – 3

- Correct handling of 0, 1, and negative numbers
- Efficient \sqrt{n} optimization
- Clear output format

Task Description – 4

Prompt-Guided UI Design for Student Grading System

Objective:

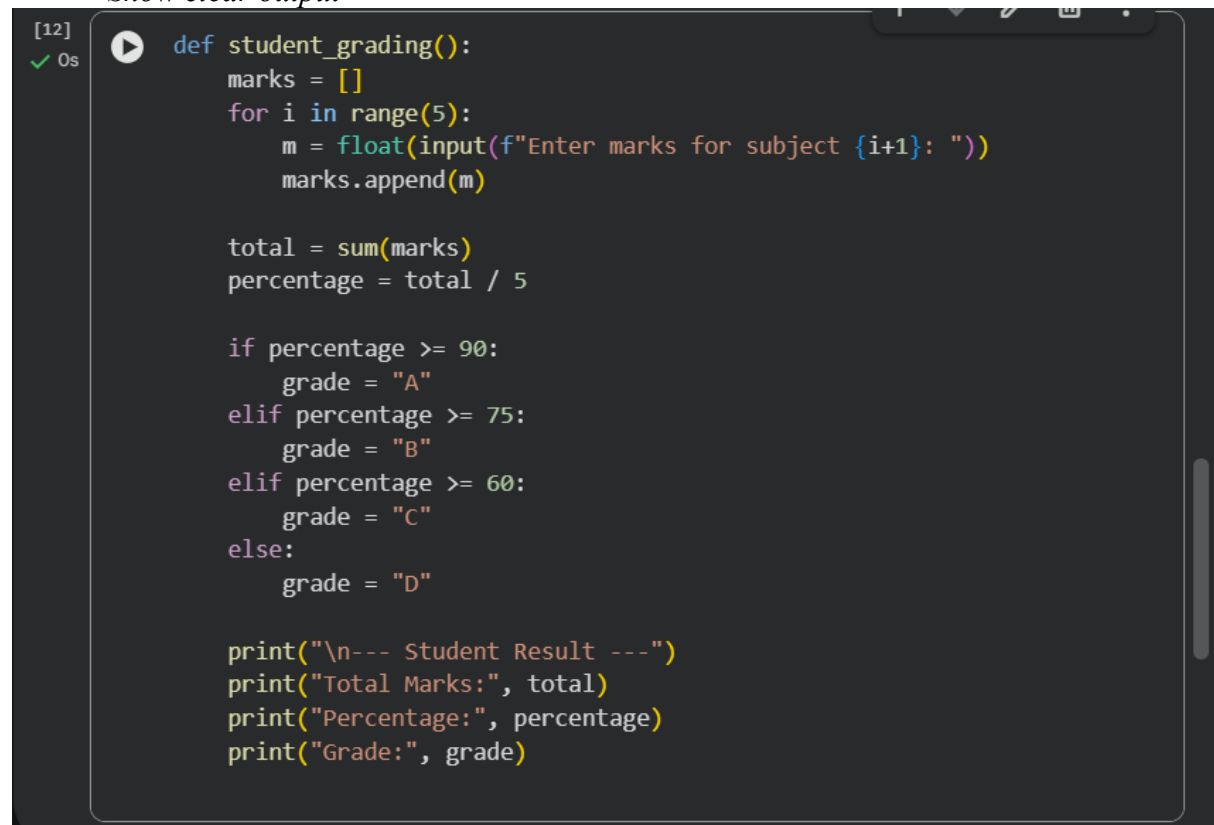
To generate a simple UI-based program that calculates **total marks, percentage, and grade** using prompt guidance.

Prompt

“Design a Python UI program for a student grading system.

The program should:

- *Accept marks of 5 subjects*
- *Calculate total and percentage*
- *Display grade based on percentage*
- *Show clear output”*

A screenshot of a code editor window with a dark background. The code is written in Python and defines a function named 'student_grading()'. The function initializes an empty list 'marks', loops through 5 subjects to collect marks as floats, calculates the total and percentage, and then uses if-elif-else logic to assign a grade (A, B, C, or D) based on the percentage. Finally, it prints the student result, total marks, percentage, and grade. The code is syntax-highlighted with various colors for keywords, strings, and variables. On the left side of the editor, there is a status bar showing '[12]' and '0s'.

Expected Output – 4

- Clean UI flow
- Accurate calculations
- Easy-to-read result display
- Logic directly guided by prompt clarity

Task Description – 5

Analyzing Prompt Specificity in Unit Conversion Functions

Objective:

To analyze how clearer instructions improve accuracy in unit conversion functions.

Prompt 1: Vague Prompt

“Write a function to convert distance.”

```
[13]
✓ 0s def convert(distance):
      return distance * 1.6
```

Issue:

- Conversion direction unclear
- No flexibility

Prompt 2: Refined Prompt

“Write a function to convert kilometers to miles.”

```
[14]
✓ 0s def convert(distance):
      return distance * 1.6
```

Prompt 3: Fully Specific Prompt

```
[15]
✓ 0s def convert_distance(value, unit):
      if not isinstance(value, (int, float)):
          return "Invalid input"

      if unit == "km":
          return value * 0.621371
      elif unit == "miles":
          return value / 0.621371
      else:
          return "Invalid unit"
```

Expected Output – 5 (Analysis)

Prompt Type Accuracy Flexibility Validation

Vague	Low	None	None
Refined	High	Partial	None
Specific	Very High	High	Yes

Final Result :

- Prompt refinement leads to:
 - Better logic
 - Improved validation
 - More efficient algorithms
- Few-shot prompting significantly improves **edge-case handling**
- UI-based programs benefit greatly from **clear task decomposition**

Conclusion

This lab demonstrates that **prompt specificity and context management are critical** in AI-assisted programming. As prompts evolve from vague to well-defined, the generated code becomes more accurate, efficient, and usable. Few-shot prompting and UI-guided prompts further enhance reliability and structure.