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.

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.

Tools Used
- Google Gemini (Google Colab)
- Cursor AI
- Python 3.x

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):

```
[3]    ▶  def calculator():
 Os            pass
```

Observation
- AI lacks context
- No logic, parameters, or functionality
- Output is incomplete and unusable

Step 2: Prompt with Comments (Added Context):

```
[4]    ▶  def calculator(a, b, operator):
 Os            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]    ▶  def calculator(a, b, operator):
 Os           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

```
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

```
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]     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 edgecase handling.

Few-Shot Prompt:

```
[9]     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]    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 √n optimization
- Clear output format

Task Description – 4

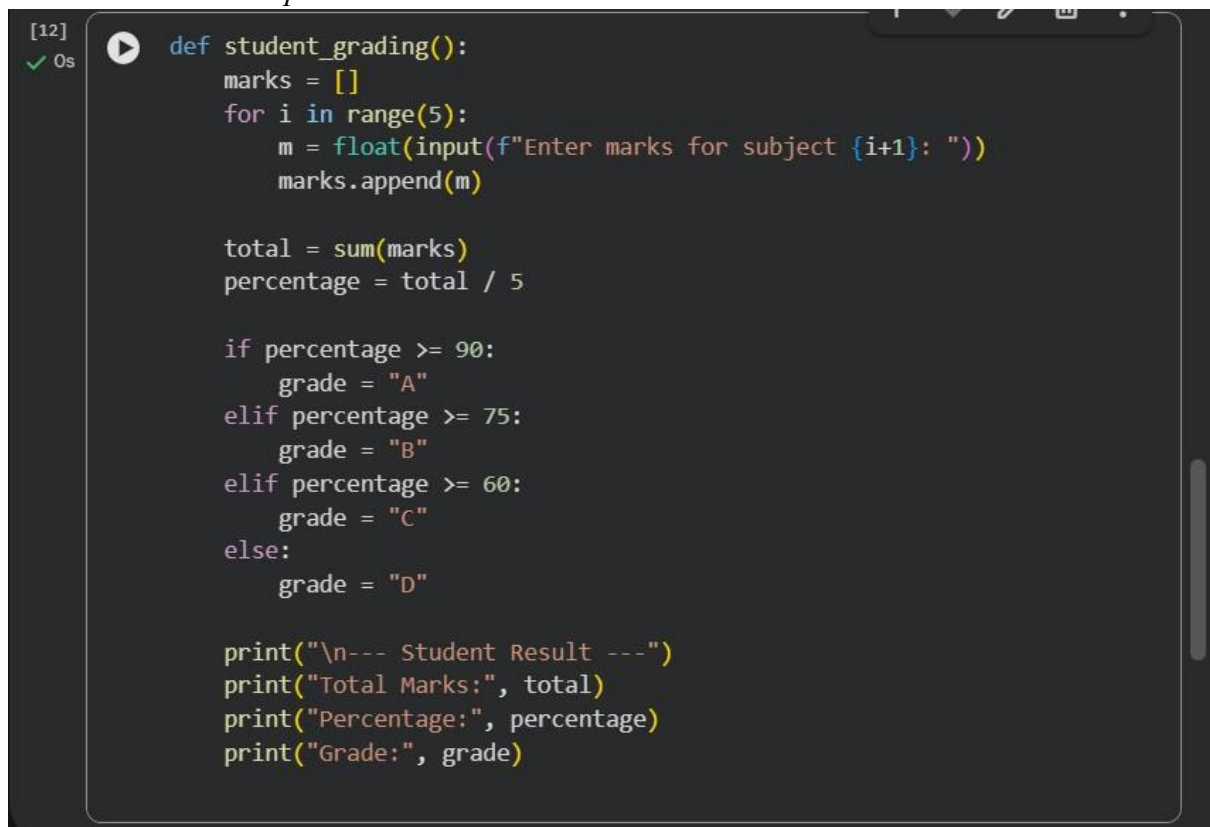## Prompt-Guided UI Design for Student Grading System
Objective:
To generate a simple UI-based program that calculates **total marks, percentage, and grade** using prompt guidance.

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"*

```python
def student_grading():
    marks = []
    for i in range(5):
        m = float(input(f"Enter marks for subject {i+1}: "))
        marks.append(m)

    total = sum(marks)
    percentage = total / 5

    if percentage >= 90:
        grade = "A"
    elif percentage >= 75:
        grade = "B"
    elif percentage >= 60:
        grade = "C"
    else:
        grade = "D"

    print("\n--- Student Result ---")
    print("Total Marks:", total)
    print("Percentage:", percentage)
    print("Grade:", grade)
```

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

Prompt Type	Accuracy	Flexibility	Validation
Vague	Low	None	None
Refined	High	Partial	None
Specific	**Very High**	**High**	**Yes**

Final Result :
- Prompt refinement leads to:

- o   Better logic o Improved
  validation o   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 AIassisted 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.