

## **School of Computer Science and Artificial Intelligence**

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### **Lab Assignment # 3.2**

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**Program : B. Tech (CSE)**  
**Specialization : AIML**  
**Course Title : AI Assisted**  
**Coding Course Code: 23CS002PC304**  
**Semester : VI**  
**Academic Session : 2025-2026**  
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**Enrollment No. : 2303A52103**  
**Batch No. : 33**  
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## Lab 3: Prompt Engineering – Improving Prompts and Context Management

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### 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

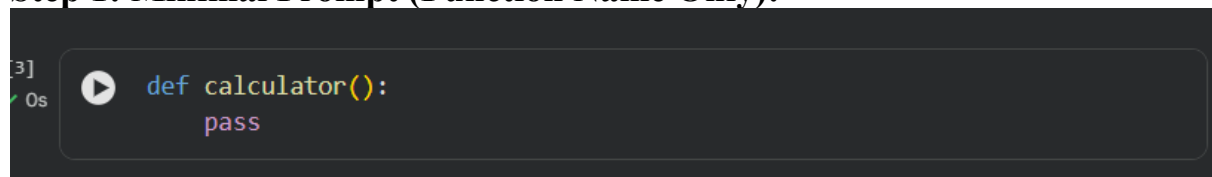
### Progressive Prompting for Calculator Design

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 color. 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

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**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	<b>Excellent</b>	Full	High	<b>Very High</b>

## 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	<b>Very High</b>	<b>Full</b>	<b>High</b>

## 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:

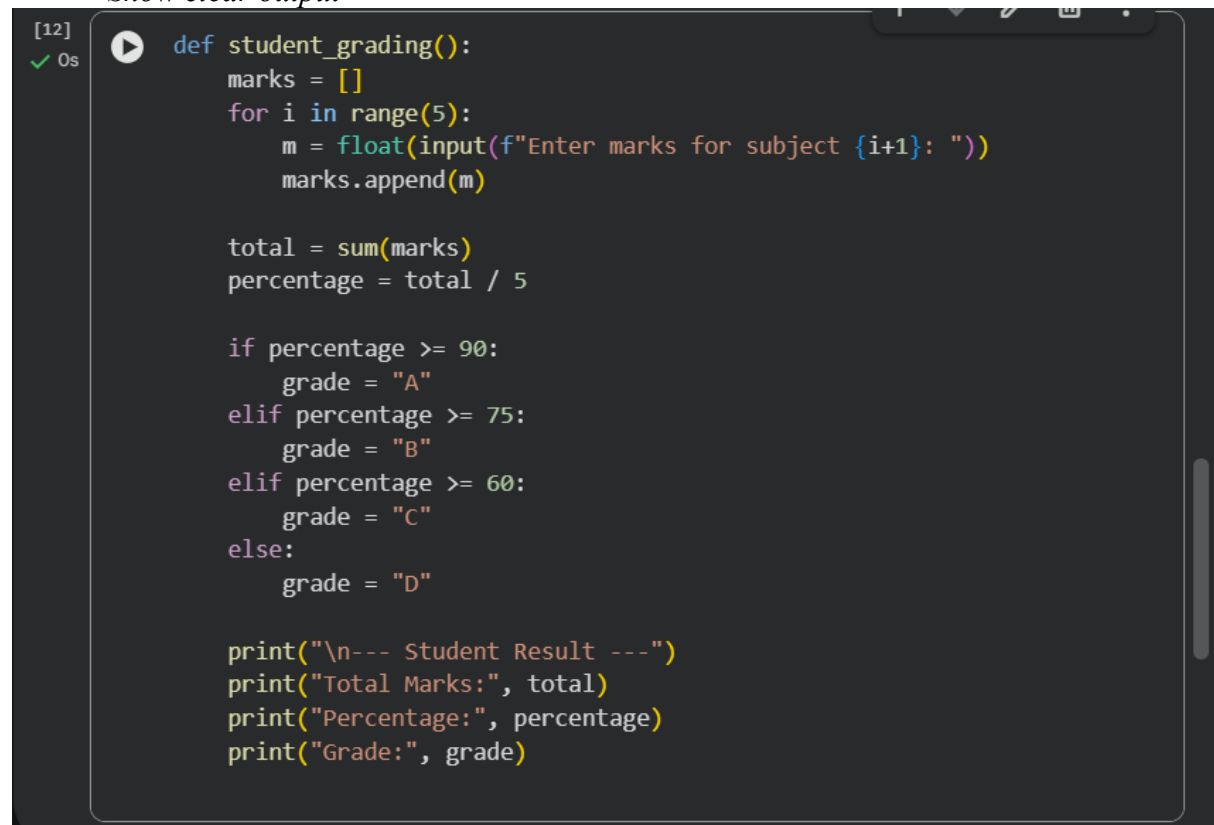
To generate a simple UI-based program that calculates **total marks, percentage, and grade** using prompt guidance.

### 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 Python IDE with a dark theme. On the left, there is a sidebar with a file explorer showing a file named '0s'. The main editor area contains a Python function definition for 'student\_grading()'. The code includes a loop to accept marks for 5 subjects, calculates the total and percentage, and uses if-elif-else statements to determine the grade (A, B, C, or D). Finally, it prints the student result, total marks, percentage, and grade. The code is as follows:

```
[12]
✓ 0s
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

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#### 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
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Vague	Low	None	None
Refined	High	Partial	None
Specific	<b>Very High</b>	<b>High</b>	<b>Yes</b>

#### 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**

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#### 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.

