

COURSE: AI Assisted Coding

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BATCH-34

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Lab 3: Prompt Engineering: Improving prompt and context management

Objective: To explore how variations in prompt structure affect the quality, completeness, and accuracy of responses from a large language model.

Requirements:

- VS Code with GitHub Copilot or Cursor API and/or Google Colab with Gemini
- Tasks to be completed are as below.

Task 1: Conceptual Understanding in Physics

Scenario

Suppose that you are a data assistant developer for an EdTech company that uses ChatGPT to answer student queries related to introductory physics.

Tasks to be completed

1. Baseline Prompt Testing

Choose 5 typical user queries, for example:

"Explain, What, Define, Why, What"

- Run these prompts in a chat-based AI model and record the raw responses.

```
File Edit Selection View Go ... < > 260108
EXPLORER J sun.java Lab3_Prompt_Engineering.md
Lab3_Prompt_Engineering.md
index.html J sum.java ph.py Lab3_Prompt_Engineering.md
1  ## Task 1: Conceptual Understanding in Physics > ## Baseline Prompts and Responses
2
3  ### Baseline Prompts and Responses
4
5  **Prompt 1:** Explain Newton's First Law of Motion.
6  **Response:** Proceeding to explain Newton's First Law of Motion.Newton's First Law (the law of inertia): An object at rest stays at rest, and an object in motion continues moving at constant velocity (same speed and direction), unless a net external force acts on it. It means objects resist changes to their motion-this resistance is called inertia. Example: a book stays on a table until you push it; a passenger lurches forward when a car stops suddenly because their body tends to keep moving.
7
8  ...
9
10 **Prompt 2:** What is acceleration?
11 **Response:** Acceleration is the rate of change of velocity with respect to time ( $a = \Delta v/\Delta t$ ), measured in meters per second squared ( $m/s^2$ ). For example, if a car goes from 0 to 20 m/s in 5 s, its acceleration is  $(20-0)/5 = 4 m/s^2$ .
12
13 **Prompt 3:** Define work in physics.
14 **Response:** Let me define work in physics. Work is done when a force causes a displacement of an object in (or with a component along) the direction of the force. Mathematically:  $W = F \cdot d = F d \cos\theta$ , and the SI unit is the joule (J).
15
16
17 **Prompt 4:** Why does an object fall towards the Earth?
18 **Response:** According to Newton's law of universal gravitation, the force is proportional to the product of the masses and inversely proportional to the square of the distance between them.
19 Near Earth's surface, this gravitational pull produces a nearly constant acceleration of about  $9.81 m/s^2$  downward, so an unbalanced force makes objects accelerate toward the ground (they "fall").
20 Example: When you drop a ball, gravity pulls it downward, causing it to speed up as it falls until it hits the ground.
21
22 ...
23
24 **Prompt 5:** What is energy?
25 **Response:** Energy is the capacity to do work. It exists in various forms such as kinetic energy, potential energy, thermal energy, and electrical energy.
26
27 ...
28
29
30
31
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34
35
36
37
38
39
```

Chat interface on the right:

- EXPLANATION OF NEWTON'S FIRST LAW -
 $d = F d \cos\theta$ and the SI unit is the joule (J).
- Why does an object fall towards the Earth?
Let me explain why objects fall toward the Earth.# Why objects fall toward the Earth?
- Gravity is an attractive force that masses exert on each other. The Earth's large mass creates a gravitational pull that attracts nearby objects toward Earth's center.
- According to Newton's law of universal gravitation, the force is proportional to the product of the masses and inversely proportional to the square of the distance between them.
- Near Earth's surface, this gravitational pull produces a nearly constant acceleration of about $9.81 m/s^2$ downward, so an unbalanced force makes objects accelerate toward the ground (they "fall").
- Example: When you drop a ball, gravity pulls it downward, causing it to speed up as it falls until it hits the ground.

2. Prompt Refinement

Rewrite each query using the following strategies:

- Add 5 different contexts (school level, competitive exam, real-life application, mathematical focus, conceptual focus).
 - Make the task explicit (e.g., “List and explain Newton’s three laws with one real-world example each.”).
 - Break the query into subtasks (definition → explanation → example).

Run these prompts in a chat-based AI model and record the raw responses.

```
def sum_jars(jar_count, jar_weight):  
    """  
    :param int jar_count: number of jars  
    :param float jar_weight: weight of one jar  
    :return float: total weight of all jars  
    """  
    return jar_count * jar_weight  
  
# Test the function  
sum_jars(5, 0.5)
```

3. Evaluate Outputs

Score AI responses on a scale of 1–5 using:

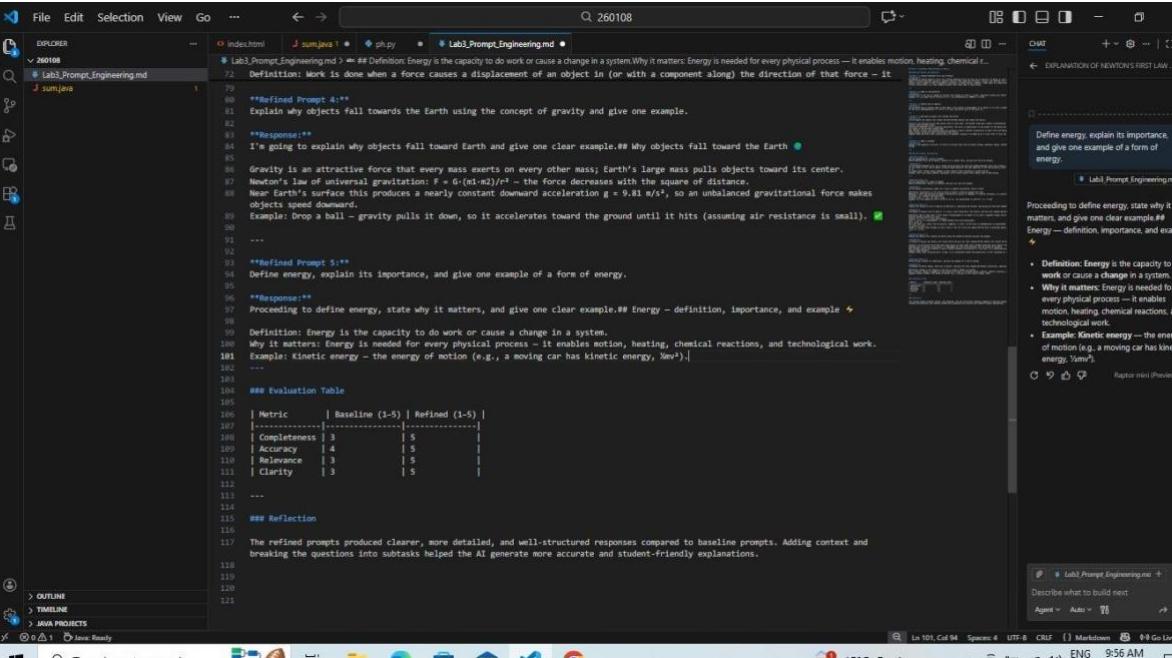
- Completeness
 - Accuracy
 - Relevance
 - Clarity

Run these prompts in a chat-based AI model and record the raw responses.

Present results in a comparative table.

4. Reflection

Discuss how contextual and structured prompts influenced the depth and correctness of responses.



```
File Edit Selection View Go < > 260108 Q. 260108

EXPLORER index.html sum.java ph.py Lab3_Prompt_Engineering.md

Lab3_Prompt_Engineering.md == ## Definition: Energy is the capacity to do work or cause a change in a system. Why it matters: Energy is needed for every physical process — it enables motion, heating, chemical reactions, and technological work.

Definition: Work is done when a force causes a displacement of an object in (or with a component along) the direction of that force — it is measured by the product of force and distance.

**Refined Prompt 4:** Explain why objects fall toward the Earth using the concept of gravity and give one example.

**Response:** I'm going to explain why objects fall toward Earth and give one clear example.## Why objects Fall toward the Earth

Gravity is an attractive force that every mass exerts on every other mass; Earth's large mass pulls objects toward its center. Newton's law of universal gravitation:  $F = G \frac{(m_1 m_2)}{r^2}$  — the force decreases with the square of distance. Near Earth's surface this produces a nearly constant downward acceleration  $g = 9.81 \text{ m/s}^2$ , so an unbalanced gravitational force makes objects speed downward.

Example: Drop a ball — gravity pulls it down, so it accelerates toward the ground until it hits (assuming air resistance is small). ▶

**Refined Prompt 5:** Define energy, explain its importance, and give one example of a form of energy.

**Response:** Proceeding to define energy, state why it matters, and give one clear example.## Energy - definition, importance, and example

Definition: Energy is the capacity to do work or cause a change in a system.

Why it matters: Energy is needed for every physical process — it enables motion, heating, chemical reactions, and technological work.

Example: Kinetic energy — the energy of motion (e.g., a moving car has kinetic energy,  $K = \frac{1}{2}mv^2$ ). ▶

*** Evaluation Table

| Metric | Baseline (1-5) | Refined (1-5) |
| --- | --- | --- |
| Completeness | 3 | 5 |
| Accuracy | 4 | 5 |
| Relevance | 3 | 5 |
| Clarity | 3 | 5 |

*** Reflection

The refined prompts produced clearer, more detailed, and well-structured responses compared to baseline prompts. Adding context and breaking the questions into subtasks helped the AI generate more accurate and student-friendly explanations.
```

Task 2: Programming Fundamentals (Python)

Scenario

Suppose that you are a data assistant developer for an EdTech platform that supports beginner programming students. Tasks to be completed

1. Baseline Prompt Testing

Choose 5 common user queries, such as:

- “What, Explain, How, What, Difference”

Run these prompts in a chat-based AI model and record the raw responses.

The screenshot shows a Microsoft Edge browser window with the following details:

- Title Bar:** File, Edit, Selection, View, Go, 26108
- Address Bar:** Lab_Prompt_Engineering.md
- Content Area:** A Python tutorial with annotations.
 - Annotations by 'Jesse':** Includes definitions for 'Definition: Energy is the capacity to do work or cause a change in a system. Why it matters: Energy is needed for every physical process — it enables motion, heating, chemical reactions, and technological work. Example: Kinetic energy.' and 'Definition: A list is an ordered, mutable collection that can hold elements of any type (duplicates allowed). Syntax: my_list = [item1, item2, ...] Common operations: indexing (my_list[0]), slicing (my_list[:1]), append (my_list.append(x)), length (len(my_list)). Examples: Use lists when you need an ordered, changeable sequence of items.'
 - Code Snippets:** Task 1: Programming Fundamentals (Python), Baseline Prompts and Responses, Prompt 1: What is Python?, Prompt 2: Explain a loop in Python., Prompt 3: What is a function?, Prompt 4: What is a list in Python?, Prompt 5: Difference between for loop and while loop., Refined Prompts and Responses.
- Bottom Navigation:** OUTLINE, TIMELINE, JAVA PROJECTS, JIRA READY, Type here to search, and various icons for file operations.
- Right Sidebar:** Chat interface with messages from 'BSE smllcap' and 'Jesse'.
- Bottom Status Bar:** BSE smllcap -1.74%, ENG 1005 AM IN 10/10/2026

2. Prompt Refinement Rewrite each query by:

- Adding 5 contexts (beginner, exam-oriented, real-world analogy, syntax-focused, performance-focused).
 - Making instructions explicit (e.g., “Define a Python loop and show one example for forloop and while-loop.”).
 - Breaking into subtasks (definition → syntax → example → use case).

Run these prompts in a chat-based AI model and record the raw responses.

3. Evaluate Outputs

- Evaluate responses using completeness, accuracy, relevance, and clarity.
 - Summarize findings in a table.

4. Reflection

Analyze, how explicit subtasks improve code correctness and explanation quality.

Task 3: Data Science and Machine Learning Concepts

Scenario

Suppose that you are a data assistant developer for an EdTech company offering data science courses.

Tasks to be completed

1. Baseline Prompt Testing

```
def calculate_area(length, width):
    return length * width

print(calculate_area(3, 4))
```

The screenshot shows a Microsoft Edge browser window with a Jupyter Notebook cell. The cell contains the following Python code:

```
def calculate_area(length, width):
    return length * width

print(calculate_area(3, 4))
```

The output of the code is displayed below the cell, showing the result of the calculation:

12

2. Prompt Refinement Refine each query by:

- Adding 5 contexts (academic, industry, beginner-friendly, mathematical, interview focused).
- Making tasks explicit (e.g., “Define supervised learning and explain it with one real-world example.”).
- Breaking into subtasks (definition → types → example → limitation).

Run these prompts in a chat-based AI model and record the raw responses.

3. Evaluate Outputs

Score outputs using the given metrics and present results in a table.

4. Reflection

Reflect on how context management affects conceptual clarity in technical domains.

The screenshot shows a Java IDE interface with the following details:

- File Bar:** File, Edit, Selection, View, Go, etc.
- Toolbars:** Standard toolbar with icons for file operations.
- Code Editor:** Displays a file named "Lab3_Prompt_Engineering.md". The content of the file is as follows:

```
Prompt_Engineering.md
115 Refined Prompt 1:
116 Define data science, explain its components, and one real-world example.
117 Response:
118 Data science is the field of analyzing data using statistics, programming, and machine learning.
119 For example, predicting stock prices uses data science.
120
121 Refined Prompt 2:
122 Explain machine learning with definition and example.
123 Response:
124 Machine learning enables systems to learn patterns from data without explicit programming.
125 For example, email spam detection.
126
127 Refined Prompt 3:
128 Define supervised learning with example and limitation.
129 Response:
130 Supervised learning uses labeled data to train models.
131 For example, predicting house prices. A limitation is dependency on labeled data.
132
133 Refined Prompt 4:
134 Explain dataset types with example.
135 Response:
136 Datasets can be structured or unstructured.
137 For example, Excel sheets are structured datasets.
138
139 Refined Prompt 5:
140 Explain ML model lifecycle.
141 Response:
142 Model lifecycle includes data collection, training, testing, and deployment.
143
144 Evaluation Table
145 | Metric | Baseline (1-5) | Refined (1-5) |
146 | Completeness | 2 | 5 |
147 | Accuracy | 4 | 5 |
148 | Relevance | 3 | 5 |
149 | Clarity | 3 | 5 |
150
151 Context-based prompts improved conceptual clarity and practical understanding of ML concepts.
```

- Right Panel:** Shows a "CHAT" section with a message about the difference between for loop and while loop, and code snippets for both loops in Python.
- Status Bar:** Shows the current temperature (16°C), weather (Partly sunny), system time (10:12 AM), and date (1/10/2026).

Task 4: Database and SQL Queries

Scenario

Suppose that you are a data assistant developer supporting students learning database systems.

Tasks to be completed

1. Baseline Prompt Testing

Choose 5 common queries, such as:

- “Explain, What, Difference, where, how”

Run these prompts in a chat-based AI model and record the raw responses.

The screenshot shows a code editor interface with the following details:

- File Bar:** File, Edit, Selection, View, Go, ...
- Title Bar:** 260108, CHAT, EXPLANATION OF NEWTON'S FIRST LAW...
- Explorer:** Shows a Java project with files like Lab3_Prompt_Engineering.md, sum.java, and ph.py.
- Editor:** Displays a Markdown file with numbered prompts and their responses. Some lines are marked with green checkmarks (e.g., "## Reflection", "For loop").
- Sidebar:** Titled "EXPLANATION OF NEWTON'S FIRST LAW...", it contains sections for "For loop vs While loop" and "For loop". It includes examples of Python code for both loops and notes about their usage.
- Bottom Status Bar:** Shows file path (Lab3_Prompt_Engineering.md), line/col (Ln 467 Col 40), encoding (UTF-8), and date/time (10/10/2026).
- System Tray:** Shows weather (16°C Partly sunny), battery level, and system status.

2. Prompt Refinement Rewrite each prompt by:

- Adding 5 contexts (theory exam, practical lab, interview prep, real-world database, optimization focus).
- Making instructions explicit (e.g., “Explain SQL JOIN types with syntax and examples.”).
- Breaking into subtasks (definition → syntax → example → use case).

Run these prompts in a chat-based AI model and record the raw responses.

3. Evaluate Outputs

Evaluate responses using the four metrics and summarize results in a comparison table.

4. Reflection

Discuss how refined prompts reduce ambiguity in technical explanations.

```

File Edit Selection View Go ... 260108 CHAT
EXPLORER Lab3_Prompt_Engineering.md ...
Lab3_Prompt_Engineering.md
Prompt_Engineering.md > ## Definition: Energy is the capacity to do work or cause a change in a system. Why it matters: Energy is needed for every physical process — it enables motion, heating, chemicals, etc. > === Reflection
115     Definition: Energy is the capacity to do work or cause a change in a system.
116     ## Reflection
117
118     Refined Prompts and Responses
119
120     Refined Prompt 1:
121         Explain SQL with use case and example.
122
123     Response:
124         SQL is used to store, retrieve, and manage data in relational databases.
125         For example, retrieving student records.
126
127     Refined Prompt 2:
128         Explain primary key with example.
129
130     Response:
131         A primary key uniquely identifies each record in a table.
132         For example, student ID.
133
134     Refined Prompt 3:
135         Differentiate DELETE and DROP with syntax.
136
137     Response:
138         DELETE removes records, DROP deletes entire table structure.
139
140     Refined Prompt 4:
141         Explain JOIN types with example.
142
143     Response:
144         JOIN combines rows from multiple tables.
145         For example, INNER JOIN retrieves common records.
146
147     Refined Prompt 5:
148         Explain normalization with benefits.
149
150     Response:
151         Normalization organizes data efficiently and avoids redundancy.
152
153     Evaluation Table
154
155     | Metric | Baseline (1-5) | Refined (1-5) |
156     |-----|-----|-----|
157     | Completeness | 5 | 5 |
158     | Accuracy | 4 | 5 |
159     | Relevance | 3 | 5 |
160     | Clarity | 3 | 5 |
161
162     Reflection:
163
164     Refined prompts reduced ambiguity and improved technical explanation clarity.

```

Task 5: General Aptitude and Logical Reasoning

Scenario

Suppose that you are a data assistant developer for an EdTech company focused on aptitude and competitive exam preparation. Tasks to be completed

1. Baseline Prompt Testing

Select 5 user queries, for example:

- “Explain, What, Difference, where, how”

Run these prompts in a chat-based AI model and record the raw responses.

```

File Edit Selection View Go ... 260108 CHAT
EXPLORER Lab3_Prompt_Engineering.md ...
Lab3_Prompt_Engineering.md
Prompt_Engineering.md > ## Definition: Energy is the capacity to do work or cause a change in a system. Why it matters: Energy is needed for every physical process — it enables motion, heating, chemicals, etc. > === Reflection
115     Definition: Energy is the capacity to do work or cause a change in a system.
116     ## Reflection
117
118     Task 5: General Aptitude and Logical Reasoning
119     Baseline Prompts and Responses
120
121     Prompt 1: What is probability?
122     Response:
123         Probability measures chance.
124
125     Prompt 2: What is average?
126     Response:
127         Average is sum divided by count.
128
129     Prompt 3: Explain ratio.
130     Response:
131         Ratio compares quantities.
132
133     Prompt 4: What is percentage?
134     Response:
135         Percentage is part of 100.
136
137     Prompt 5: What is logical reasoning?
138     Response:
139         Logical reasoning involves thinking skills.
140
141     Refined Prompts and Responses
142
143     Refined Prompt 1:
144         Define probability with formula and example.
145
146     Response:
147         Probability measures likelihood of an event.
148         Formula: Favorable / Total outcomes.
149         Example: Tossing a coin.
150
151     Refined Prompt 2:
152         Explain average with example.
153
154     Response:

```

2. Prompt Refinement Rewrite each query by:

- Adding 5 contexts (school exams, competitive exams, real-life analogy, formula-based, step-by-step solving).
 - Making tasks explicit (e.g., “Define probability and solve one simple numerical example.”).
 - Breaking into subtasks (definition → formula → example → common mistakes).

Run these prompts in a chat-based AI model and record the raw responses.

3. Evaluate Outputs

- Score responses using completeness, accuracy, relevance, and clarity.
 - Present findings in a table.

4. Reflection

Reflect on how structured prompts improve step-by-step reasoning and learner understanding.

