

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 ... < - > Q 260108
EXPLORER index.html jsum.java1 php Lab3_Prompt_Engineering.md
Lab3_Prompt_Engineering.md > ## Task 1: Conceptual Understanding in Physics > ### Baseline Prompts and Responses
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##Prompt 1:** Explain Newton's First Law of Motion.
**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.

##Prompt 2:** What is acceleration?
**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  $(20-0)/5 = 4 m/s^2$ .

##Prompt 3:** Define work in physics.
**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).

##Prompt 4:** Why does an object fall towards the Earth?
**Response**
Let me explain why objects fall toward the Earth. Why objects fall toward the Earth

##Prompt 5:** What is energy?
**Response**
Energy is the capacity to do work. It exists in various forms such as kinetic energy, potential energy, thermal energy, and electrical energy.

Raptor mini (Preview) +
```

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.

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.

The screenshot shows a code editor interface with several tabs open. The main tab contains Python code related to a physics lab. A sidebar on the right shows a chat history where the AI has responded to prompts about energy and gravity. The bottom of the screen displays a taskbar with various icons and system status information.

```
File Edit Selection View Go ... index.html J sum.java ph.py Lab3_Prompt_Engineering.md
Lab3_Prompt_Engineering.md > **Refined Prompt 4:** Explain why objects fall towards 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. The Earth's surface mass 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.

```

File Edit Selection View Go ... < > Q 260108
File Explorer Lab3_Prompt_Engineering.md sumjava Lab3_Prompt_Engineering.md
Search Lab3_Prompt_Engineering.md
Task 1: What is Python?
Definition: Python is a high-level, interpreted, general-purpose programming language with simple, readable syntax. It's widely used for web development, data science, scripting/automation, and AI, and has a large standard library plus many third-party packages (e.g., NumPy, pandas, Django).
...
Task 2: Programming Fundamentals (Python)
Baseline Prompts and Responses
...
Prompt 1: What is Python?
Response: Try to give a brief, beginner-friendly definition of Python. Python is a high-level, interpreted, general-purpose programming language with simple, readable syntax. It's widely used for web development, data science, scripting/automation, and AI, and has a large standard library plus many third-party packages (e.g., NumPy, pandas, Django).
...
Prompt 2: Explain a loop in Python.
Response: Let me give a short definition and 1-2 simple examples of Python loops. A loop repeats a block of code while a condition holds (or over items). Two common types:
for loop: iterates over a sequence.
Example:
for i in range(1, 5):
    print(i) # prints 1-5
while loop: repeats while a condition is true.
Example:
n = 0
while n < 5:
    print(n)
    n += 1 # counts down
Notes: Python uses indentation to define the loop body; use break to exit early and continue to skip to the next iteration.
...
Prompt 3: What is a function?
Response: Let me define a function and show a quick example. What is a function?
...
Definition: A function is a reusable block of code that performs a specific task. It can accept parameters (inputs), may return a value (output), and helps keep code modular and readable.
...
Python basics (short):
Usage: greet("Alisha") -> "Hello, Alisha".
why use functions: they avoid repetition, make testing easier, and clarify program structure.
...
Prompt 4: What is a list in Python?
Response: I'm going to give a concise definition of a Python list and a short example. What is a list in Python?
...
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[1:3]), append (my_list.append(x)), length (len(my_list)).
...
Use lists when you need an ordered, ...
Prompt 5: Difference between for loop and while loop.
Response: A for loop is used when the number of iterations is known, whereas a while loop is used when the condition is based on logic.
...
Refined Prompts and Responses
...
Refined Prompt 1:
Explain Python to a beginner, mention its features, and one real-life use.
...

```

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 for-loop 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.

```

File Edit Selection View Go ... < > Q 260108
File Explorer Lab3_Prompt_Engineering.md sumjava Lab3_Prompt_Engineering.md
Search Lab3_Prompt_Engineering.md
...
Refined Prompts and Responses
...
Refined Prompt 1:
Explain Python to a beginner, mention its features, and one real-life use.
...
Response:
Let me give a brief beginner-friendly explanation of Python, list its key features, and show one practical use. What is Python?
...
Python is a high-level, interpreted, general-purpose programming language with clear, readable syntax that makes it easy to learn and use.
...
Key features:
Simple, readable syntax - great for beginners and fast development.
Interpreted & cross-platform - runs on Windows, macOS, Linux without compilation.
Large standard library ("batteries included") and a huge ecosystem of packages (pip).
Dynamic typing and automatic memory management (garbage collection).
Supports multiple paradigms - procedural, object-oriented, and functional programming.
Strong community & libraries for web, data science, automation, and AI (e.g., Django, pandas, NumPy, TensorFlow).
...
Refined Prompt 2:
Define a loop, explain its syntax, and give one example.
...
Response:
...
Proceeding to define loops and show a short syntax example. Loop - definition, syntax, and example
...
Definition: A loop repeats a block of code while a condition holds or over each item in a sequence.
...
Common syntax (Python):
...
For loop: for item in sequence:
While loop: while condition:
Example (for loop - print 1-5):
...
Tip: Python uses indentation for the loop body; use break to exit early and continue to skip to the next iteration.
...
Refined Prompt 3:
Explain functions with definition, syntax, and example.
...
Response:
...
Functions - definition, syntax, and example
...
Definition: A function is a reusable block of code that performs a specific task, optionally takes parameters, and may return a value.
...
Syntax (Python):
...
Example: a simple function that adds two numbers:
...
Why use them: Functions improve modularity, reduce repetition, and make code easier to test and maintain.
...
Refined Prompt 4:
Explain lists with syntax and use case.
...

```

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.

The screenshot shows a Microsoft Visual Studio Code (VS Code) interface. The top bar includes File, Edit, Selection, View, Go, and a search bar. The left sidebar has sections for Explorer, OUTLINE, TIMELINE, and JAVA PROJECTS. The main area displays a file named Lab3_Prompt_Engineering.md with the following content:

```
index.html J sumjava ! .py Lab3_Prompt_Engineering.md 260108

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... > ## Reflection
99 Definition: Energy is the capacity to do work or cause a change in a system.
100
101 ## Reflection
102
103 Refined Prompt 4:
104 Explain lists with syntax and use case.
105
106 Response:
107 Let me explain lists with syntax and a simple use case.## Lists in Python
108
109 Definition: A list is an ordered, mutable collection that can contain items of any type (duplicates allowed).
110
111 Syntax & common operations
112 Create: my_list = [1, 'a', 3.14]
113 Indexing: my_list[0] -> first item
114 Slicing: my_list[1:3] -> sublist
115 Add / remove: my_list.append(x), my_list.remove(x)
116 Length: len(my_list)
117 Iterate: for item in my_list: ...
118 Note: Lists are mutable (you can change them). Use a tuple ((a, b)) when you need an immutable sequence.
119
120 Refined Prompt 5:
121 Differentiate between for loop and while loop with example.
122
123 Response:
124 or loop vs While loop
125 For loop
126
127 Use when you need to iterate over a sequence or a known range.
128 Python syntax:
129 While loop
130
131 Use when you need to repeat until a condition becomes false (count-controlled or unknown iterations).
132 Python syntax:
133 Tip: use for for definite iterations and while for conditional/repeat-until logic; be careful of infinite while loops.
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146 | Metric | Baseline (1-5) | Refined (1-5) |
147 |-----|-----|-----|
148 | Completeness | 3 | 5 |
149 | Accuracy | 4 | 5 |
150 | Relevance | 3 | 5 |
151 | Clarity | 3 | 5 |
152
153
154 Explicit instructions and structured prompts significantly improved explanation quality and code understanding.
```

The right side of the interface shows a Chat window with a message about differentiating between for and while loops, and a preview of another file, Lab3_Prompt_Engineering.md + 1x.

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

Select 5 typical queries, for example:

- “What, Explain, What, Define, What”

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, ...
- Search Bar:** Q 260108
- Explorer:** 260108, Lab3_Prompt_Engineering.md, sum.java, ph.py, Lab3_Prompt_Engineering.md
- Code Area:**

```

Prompt_Engineering.md > ## Definitions: Energy is the capacity to do work or cause a change in a system. Why it matters: Energy is needed for every physical ...
99 Definition: Energy is the capacity to do work or cause a change in a system.
115 ### Reflection
253
254 Explicit instructions and structured prompts significantly improved explanation quality and code understanding.
255
256
257 Task 3: Data Science and Machine Learning Concepts
258 Baseline Prompts and Responses
259
260 Prompt 1: What is data science?
261 Response:
262 Data science deals with extracting insights from data.
263
264 Prompt 2: Define machine learning.
265 Response:
266 Machine learning allows systems to learn from data.
267
268 Prompt 3: What is supervised learning?
269 Response:
270 Supervised learning uses labeled data.
271
272 Prompt 4: What is a dataset?
273 Response:
274 A dataset is a collection of data.
275
276 Prompt 5: What is a model?
277 Response:
278 A model is a trained algorithm.
279
280 Refined Prompts and Responses
281
282 Refined Prompt 1:
283 Define data science, explain its components, and one real-world example.
284
285 Response:
286 Data science is the field of analyzing data using statistics, programming, and machine learning.
287 For example, predicting stock prices uses data science.
288

```
- Chat Panel:**
 - For loop vs While loop
 - For loop: Use when you need to iterate over a sequence or a known range. Python syntax: `for i in range(1, 6): print(i)`
 - While loop: Use when you need to repeat until a condition becomes false (count-controlled or unknown iterations). Python syntax: `n = 5 while n > 0: print(n) n -= 1 # stops when n == 0`
- Bottom Status Bar:** Ln 264, Col 35, Spaces: 4, UTF-8, CRLF, Markdown, 16°C Partly sunny, ENG, 10:12 AM, IN, 1/10/2026

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.

```

for i in range(1, 6):
    print(i) # prints 1-5

```

Tip: use `for` for definite iterations and `while` for conditional/repeat-until logic; be careful of infinite `while` loops.

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.

```

for i in range(1, 6):
    print(i) # prints 1-5

```

Tip: use `for` for definite iterations and `while` for conditional/repeat-until logic; be careful of infinite `while` loops.

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.

The screenshot shows a code editor with a Jupyter Notebook cell containing Python code. The code defines a 'For loop' and a 'While loop'. It includes comments explaining the differences between them and provides examples. The code editor interface includes tabs for 'index.html', 'sum.java', 'ph.py', and 'Lab3_Prompt_Engineering.md'. The status bar at the bottom shows the date and time as 1/10/2026, 10:15 AM.

```
for i in range(1, 6):
    print(i) # prints 1-5

n = 5
while n > 0:
    print(n)
    n -= 1 # stops when n == 0
```

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
EXPLORER ... 🔍 index.html J sum.java 1 🔍 ph.py 🔍 Lab3_Prompt_Engineering.md 🔍
260108 Prompt_Engineering.md > ## Definitions Energy is the capacity to do work or cause a change in a system. Why it matters: Energy is needed for every physical ...
Lab3_Prompt_Engineering.md
J sum.java 1
99 Definition: Energy is the capacity to do work or cause a change in a system.
115 ### Reflection
399
400 Task 5: General Aptitude and Logical Reasoning
401 Baseline Prompts and Responses
402
403 Prompt 1: What is probability?
404 Response:
405 Probability measures chance.
406
407 Prompt 2: What is average?
408 Response:
409 Average is sum divided by count.
410
411 Prompt 3: Explain ratio.
412 Response:
413 Ratio compares quantities.
414
415 Prompt 4: What is percentage?
416 Response:
417 Percentage is part of 100.
418
419 Prompt 5: What is logical reasoning?
420 Response:
421 Logical reasoning involves thinking skills.
422
423 Refined Prompts and Responses
424
425 Refined Prompt 1:
426 Define probability with formula and example.
427
428 Response:
429 Probability measures likelihood of an event.
430 Formula: Favorable / Total outcomes.
431 Example: Tossing a coin.
432
433 Refined Prompt 2:
434 Explain average with example.
435
436 Response:

```

CHAT 🔍 EXPLANATION OF NEWTON'S FIRST LAW ... 🔍 Lab3_Prompt_Engineering.md 230-231 🔍

For loop vs While loop

For loop

- Use when you need to iterate over a sequence or a known range.
- Python syntax:

```
for i in range(1, 6):
    print(i) # prints 1-5
```

While loop

- Use when you need to repeat until a condition becomes false (count-controlled or unknown iterations).
- Python syntax:

```
n = 5
while n > 0:
    print(n)
    n -= 1 # stops when n == 0
```

Tip: use `for` for definite iterations and `while` for conditional/repeat-until logic; be careful of infinite `while` loops.

Raptor mini (Preview) + 1x 🔍 Lab3_Prompt_Engineering.md + 🔍 Describe what to build next Agent Auto 🔍 1/10/2026 🔍

Ln 469, Col 12 Spaces: 4 UTF-8 CRLF 🔍 Markdown 🔍 Go Live 🔍

16°C Partly sunny 🔍 ENG 10:16 AM IN 🔍

Type here to search 🔍

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.

The screenshot shows a Microsoft Visual Studio Code (VS Code) interface. The main area displays a Markdown file named `Lab3_Prompt_Engineering.md`. The content of the file includes several code snippets and explanatory text. A sidebar on the right contains a Python code editor with examples for loops.

Markdown Content:

```
39 Definition: Energy is the capacity to do work or cause a change in a system.
40
41 Refined Prompt 1:
42 Define probability with formula and example.
43
44 Response:
45 Probability measures likelihood of an event.
46 Formula: Favorable / Total outcomes.
47 Example: Tossing a coin.
48
49 Refined Prompt 2:
50 Explain average with example.
51
52 Response:
53 Average is total values divided by number of values.
54 Example: Average marks of students.
55
56 Refined Prompt 3:
57 Explain ratio with example.
58
59 Response:
60 Ratio compares quantities.
61 Example: Boys to girls ratio.
62
63 Refined Prompt 4:
64 Explain percentage with real-life use.
65
66 Response:
67 Percentage represents value per hundred.
68 Example: Exam scores.
69
70 Refined Prompt 5:
71 Explain logical reasoning with example.
72
73 Response:
74 Logical reasoning involves step-by-step thinking.
75 Example: Solving puzzles.
76
77 Evaluation Table
78 +-----+-----+-----+
79 | Metric | Baseline (1-5) | Refined (1-5) |
80 +-----+-----+-----+
81 | Completeness | 2 | 5 |
82 | Accuracy | 4 | 5 |
83 | Relevance | 3 | 5 |
84 | Clarity | 3 | 5 |
85
86
87 Reflection:
88
89 Structured prompts improved step-by-step thinking.
```

Python Code Editor (Sidebar):

```
For loop ▲
For loop [green checkmark]
• Use when you need to iterate over a sequence or a known range.
• Python syntax

For i in range(1, 6):
    print(i) # prints 1-5

While loop ▲
While loop [green checkmark]
• Use when you need to repeat until a condition becomes false (count-controlled or unknown iterations).
• Python syntax

n = 5
while n > 0:
    print(n)
    n -= 1 # stops when n == 0
```

System Status Bar:

16°C Partly sunny ENG 10:17 AM IN 1/10/2026