

Prompt Engineering Techniques

TIM 175 WEEK 2 PRELAB

Today, we will be testing out different techniques for Prompt Engineering with a Large Language Model to learn and build intuition on how the quality of prompts can be improved to get more effective and specific outputs from the AI. This prelab will help you get acquainted with some popular Prompt Engineering techniques used so that you can use them in the lab and projects in the course. **This individual prelab is due Tuesday 11:59pm.**

Readings: We mark up to two readings with a ★ that we suggest you read

- [Prompt engineering: a crucial skill for small businesses? Adobe](#)
- [Prompt engineering, OpenAI Platform](#) ★
- [Introduction to Vertex AI Studio, Google Cloud](#) ★
- [Prompting Techniques, Prompt Engineering Guide](#)
- [Prompt design strategies, Google AI for Developers](#)

Submission Link

[Week 2 TIM 175 Submission Form \(Spring 2025\)](#)

Brief Task Overview

Set up [LastMile AI](#) and create a copy of this document to work through the activities. For each activity:

- Capture screenshots of the prompts you used and the outputs generated by the model. Place these images directly **above** the analysis tables of each activity.
- Use the table to write a detailed analysis of your reflections from the activity.
- **ALL NEW TEXT YOU ADD SHOULD BE IN RED TO MAKE IT EASY FOR US TO SEE.**

Complete 4 activities to understand different popular Prompt Engineering Techniques

1. Compare Zero Shot vs Few Shot Prompting
2. Practice Basic Prompting Techniques
3. Chain of Thought Techniques
4. Chain of Verification Techniques
5. (Optional) Meta-Prompting

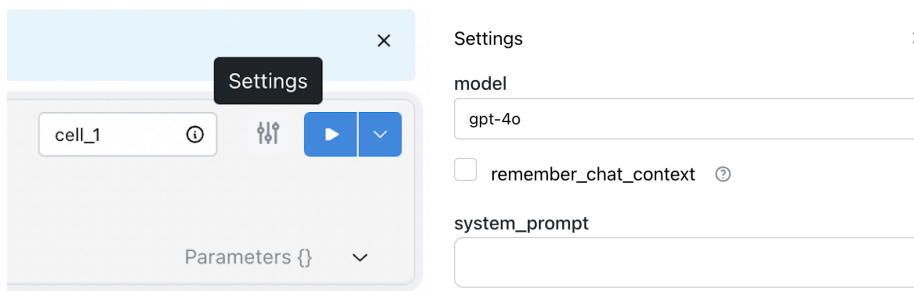
You can use ChatGPT or other GenAI tools to inform any part of the assignment but: (1) you need to first form your own independent thoughts, (2) every word included in the submission needs to be something you've read, thought about, and decided to include, and (3) you should strive towards submitting the highest quality work you can rather than mediocre work that meets the requirements.

Setting up

Set Up LastMileAI:

To try out different prompt engineering techniques we will be using the following platform: [LastMileAI](#).

1. Simply Sign in to the platform using your Google Account
2. Click on Workbooks and then “New Workbook”
3. You can experiment with different models using the dropdown on the top left. By default it is set to “ChatGPT”. For this assignment, **please change it to GPT-4**.
4. **IMPORTANT:** For this activity, go to settings on the workbook cell and deselect “remember_chat_context”



Create a copy of this document to work through the activities. For each activity:

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Prompt Engineering Techniques and Activities

Prompt Engineering is the process of designing and optimizing prompts to guide AI models to generate the desired outcomes. Remember, a model's output can only be as good as your input is - if you offer the AI a poor prompt, you can limit the quality of its response.

The techniques we will be starting off with are:

Zero-Shot Prompting: Give the AI a task without any examples or training in your prompt. This is similar to if someone asks you to do something you've never done before, but they don't give you any specific examples to follow. Instead, you have to rely entirely on what you already know or have learned in the past to figure it out.

Few Shot Prompting: Give the AI a few examples in your prompt so that the AI learns what kind of output and format you want. This handful of examples creates context learning, helping to guide the AI on how to approach this particular task. With just these few hints of user input, the AI can adjust its approach based on what it learned from the examples and perform the new task more effectively than if it had no guidance at all.

Now try out these activities below and compare the outputs between Zero-shot and Few-shot prompting.

Activity 1: Compare Zero-Shot Prompting and Few-Shot Prompting

Objective: Explore how AI responds differently to Zero-Shot Prompting (no examples) and Few-Shot Prompting (with examples). Analyze the differences in output quality, accuracy, and consistency.

Task 1: Try the following zero-shot tasks (first column) and screenshot/paste and analyze the outputs (second column). **For these tasks, Don't just copy-paste the task text as it is, instead you should write a prompt with some structure/instructions to tell the model to solve the task.**

Then practice the few-shot tasks (third column) by creating similar prompts that also provide a few examples for the task to the model and compare the new outputs (fourth column) to the ones from zero-shot (second column) for analysis.

Zero-shot Tasks	Screenshot/Outputs:	Few-shot Tasks	Screenshot/Outputs:
<p>Classify the following review as Positive, Negative, or Neutral:</p> <p>a) "The food was average, and the service was slow."</p> <p>b) "the final episode was surprising with a terrible twist at the end".</p> <p>c) "I do not dislike horror movies".</p>		<p>Classify Reviews:</p> <p>Example 1 (positive): "The movie was fantastic and kept me on the edge of my seat!"</p> <p>Example 2 (neutral) : "The hotel was clean, but the breakfast was disappointing."</p> <p>Example 3 (negative): "I will never shop here again; the service was terrible!"</p> <p>Task: Now classify this review: "The food was average, and the service was slow."</p>	

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Explain how to change a flat tire on a car.		Explain Tasks: Example 1: <i>"How to bake a cake: Preheat the oven, mix ingredients, pour into a pan, and bake."</i> Example 2: <i>"How to make a smoothie: Blend fruits, yogurt, and ice until smooth."</i> Task: Now concisely explain how to change a flat tire on a car	
Define the term "photosynthesis."		Define Terms: Example 1: <i>"Ecosystem: A community of living organisms and their environment interacting as a system."</i> Example 2: <i>"Biodiversity: The variety of life in the world or in a particular habitat."</i> Task: Now define the term "photosynthesis."	
Create a haiku about autumn leaves		Create Haikus: Example 1: <i>Whispers in the breeze, Cherry blossoms gently fall, Spring's sweet serenade.</i> Example 2: <i>Mountain peaks stand tall, A blanket of snow so white, Nature's pure embrace.</i> Task: Now create a haiku about autumn leaves.	

<p>Write a short horror story.</p>		<p>Write Short Horror Story:</p> <p>Example 1: "It was a dark and stormy night. The lights flickered, and suddenly, there was a knock at the door..."</p> <p>Example 2: "The footsteps echoed in the empty house, each step growing closer to the room where Emily hid under the bed..."</p> <p>Example 3: John was alone in the cabin, or so he thought, until he saw the reflection in the mirror behind him."</p> <p>Task: Now write a short horror story.</p>	
<p>Paraphrase the following sentence: "The rapid advancement of technology has led to significant changes in modern society."</p>		<p>Paraphrase This Sentence:</p> <p>Example 1: Original: "The economy has experienced a downturn due to global events."</p> <p>Paraphrase: "Global events have caused the economy to slow down."</p> <p>Example 2: Original: "Climate change is becoming an increasingly urgent issue."</p> <p>Paraphrase: "The issue of climate change is growing more pressing."</p> <p>Task: Now paraphrase this sentence: "The rapid advancement of technology has led to significant changes in modern society."</p>	

Analyze the outputs/responses and compare the difference between the zero-shot and few-shot prompting.

Analysis of comparison between few-shot and zero-shot (Add your reflections here):

Task 2 - Compare the difference between zero-shot and few-shot with the provided prompt below and analyze the output. **Provide the prompt and response screenshot in the analysis below and reflect on why few-shot prompting may be more effective in this scenario.**

- **Zeroshot:** To do a "farduddle" means to jump up and down really fast. Write an example of a sentence that uses the word farduddle is:
- **Few Shot:** A "whatpu" is a small, furry animal native to Tanzania. An example of a sentence that uses the word "whatpu" is: "We were traveling in Africa and we saw a group of whatpus scurrying along the ground". To do a "farduddle" means to jump up and down really fast. Write an example of a sentence that uses the word farduddle is:

	Screenshots/output here:
Zero-shot response using example given above	
Few-shot response using example given above	

Analyze and compare the outputs between Zero-shot prompts and Few-shot prompts and answer the following questions in your reflection.

- Why do you think a few-shot might be a good technique for this specific task?
- What was the difference between the zero-shot response and few-shot response? Did the AI's response improve with the few-shot example? How can providing examples help refine AI-generated responses?
- When might zero-shot prompting be sufficient? When is few-shot prompting more useful? When is it not more useful?

Your reflections here:

Task 3 - Now think of another problem context where you think few-shot may have better response than zero-shot.

	Screenshots here:
Zero-shot response (your own example)	
Few-shot response (your own example)	

Your Reflection between Few-shot and Zero-shot for your own example:

Activity 2: Practice Basic Prompting Techniques

Another technique for improving your prompts includes adding the following elements in your prompts to get more specific output for your specific context and need.

1. **Task:** start with an action word (*solve, write, analyze*)
2. **Context:** background, environment, description of what you are trying to do
3. **Example:** here's an example of....
4. **Persona:** act like (*a college professor, a doctor, a nutritionist*)
5. **Format:** format the output (*in 1 paragraph, 250 words, in a table format, a list*)
6. **Tone:** tone of voice (*professional tone, informal, humorous, pessimistic*)

Example Problem: Weekly Foods

- **Output:** "I'm sorry, but I'm not sure what you mean by "weekly foods." Can you please provide more context or specify what you are looking for?"
1. **Task:**
 - **Give me a 1 week plan for meals**
 2. **Context + Task:**
 - **I am a 130 lb male looking to gain weight**, Give me a 1 week plan for meals
 3. **Context + Example + Task:**
 - I am a 130 lb male looking to gain weight, **Here's an example of what one day should look like: Breakfast ... Lunch .. Snack ... Dinner**, Give me a 1 week plan for meals
 4. **Context + Example + Task + Format:**
 - I am a 130lb male looking to gain weight, here's an example of what one day looks like: Breakfast ... Lunch .. Snack ... Dinner, Give me a 1 week plan for meals **in bullet points**
 5. **Persona + Context + Example + Task + Format:**
 - **Act like a Nutritionist and answer the following:** I am a 130lb male looking to gain weight, here's an example of what one day looks like: Breakfast ... Lunch .. Snack ... Dinner, Give me a weekly meal plan in bullet points
 6. **Tone + Persona + Context + Example + Task + Format:**
 - **In a professional tone:** Act like a Nutritionist and answer the following: I am a 130lb male looking to gain weight, here's an example of what one day looks like: Breakfast ... Lunch .. Snack ... Dinner, give me a weekly meal plan in bullet points

Task: Start with a simple prompt using just a basic task (e.g., "solve," "write," "analyze"). Then, progressively add more detail by incorporating different prompting techniques, such as adding context, examples, personas, formats, and tone. After each iteration, review and compare how the output changes based on the increasing complexity of the prompt. Continue refining the prompt and note how each adjustment improves or modifies the result.

Above was an example, but **YOU HAVE TO THINK OF A PROBLEM CONTEXT YOURSELF** and figure out how you would add these elements to your prompt.

Your Prompt Context:

List of Your Prompts:

1. **Task:**
2. **Context** + Task:
3. Context + **Example** + Task:
4. Context + Example + Task + **Format**:
5. **Persona** + Context + Example + Task + Format:
6. **Tone** + Persona + Context + Example + Task + Format:

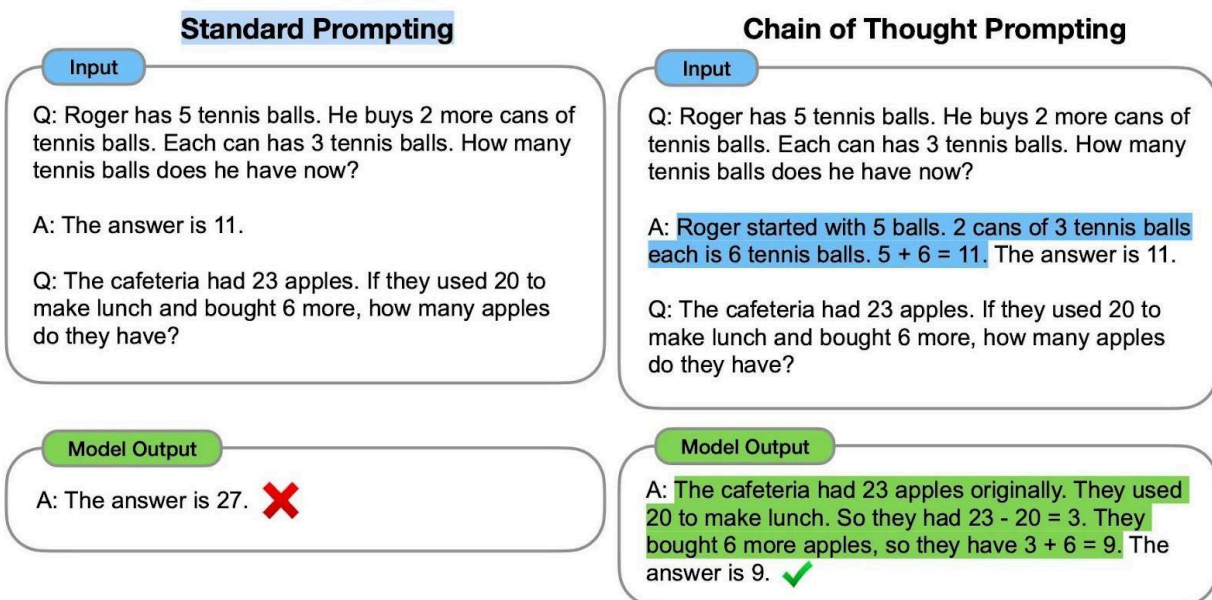
Screenshots:

Analysis for Activity 2:

Your reflections on the above activity of adding the specific elements to your prompt. How did the outputs change as you kept adding the elements one by one?

Activity 3: Chain of Thought Prompting

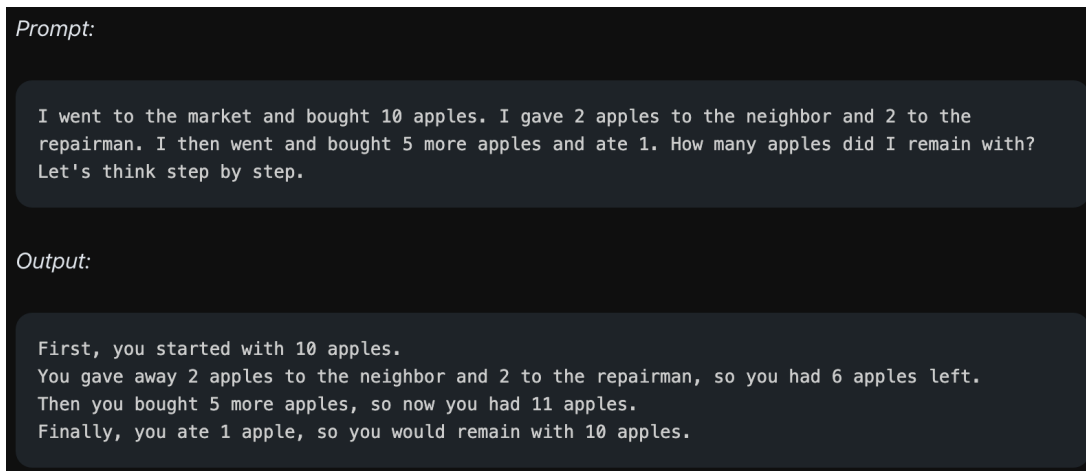
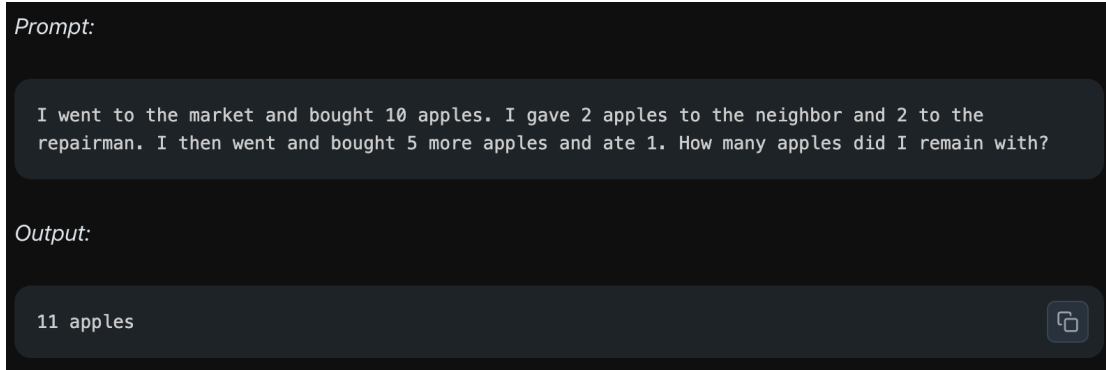
Chain of Thought Prompting is a technique that has a language model break down complex problems step-by-step, rather than providing a single, immediate response. By guiding the model to "think aloud," or outline its reasoning process, it's able to generate more accurate and logical responses, especially for tasks that involve multi-step reasoning, complex calculations, or decision-making.



There can be zero-shot CoT Prompting and Few-shot Prompting as well depending on if you add an example into the original prompt. You can read more about that [here](#):

One recent technique is the idea of zero-shot CoT (Kojima et al. 2022) that essentially involves adding "Let's think step by step" to the original prompt. Let's try a simple problem and see how the model performs:

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Task 1:

1. **Basic Prompting:** Start by giving the model a complex question without a specific reasoning structure. Observe the answer it provides.
2. **Chain of Thought Prompting:** Next, instruct the model to break down the problem into individual steps, demonstrating its reasoning process as it arrives at an answer. Compare these responses to see how step-by-step reasoning impacts the model's accuracy and logical coherence.

Writing: Consider discussing when it might be more effective to apply this technique. Reflect on tasks that benefit from step-by-step reasoning versus those that do not. Analyze how chain of thought prompting helps improve accuracy and comprehension in complex scenarios.

Prompt Images/Examples:

Task	Screenshot/Examples
Basic Prompting	
Chain of Thought Prompting	

Analysis for Activity 4:

Your reflections on Chain of Thought Prompting:

Activity 4: Chain of Verification:

Overview: Chain of Verification is a structured approach to verify the accuracy of statements generated by AI or found in any response. It increases the likelihood of factual correctness by breaking down a query into smaller components, verifying each piece, and then synthesizing a final response based on the verified facts. After trying two examples out for yourself, write an analysis reflecting on the process. Discuss what you found challenging, how the Chain of Verification helped ensure accuracy, and any insights gained about verifying information critically.

1. Define the Query
 - a. Give a clear and specific question or request
2. Obtain a Baseline Response
 - a. This will be the LLM response to your query
3. Develop a Plan for Verification
 - a. List specific questions to verify the accuracy of each claim in the baseline response. Each question should aim to fact-check one claim.
4. Execute Verifications
 - a. This will be the LLM response to your questions
5. Synthesize the Final Response
 - a. Use the verified information to create a corrected and accurate response. Remove incorrect claims and add any additional verified details if available.

Here is an example of Chain of Verification:

Query: Name some politicians who were born in NY, New York

Baseline Response:

Here are some politicians who were born in NY, New York:

1. Hillary Clinton - former secretary of state and former Democratic presidential nominee
2. Donald Trump - former president of the United States
3. Michael Bloomberg - former Mayor of New York City and former Democratic presidential candidate
4. ...
5. ...

Plan Verification:

- Where was Hillary Clinton born?
- Where was Donald Trump born?
- Where was Michael Bloomberg born?

Execute Verifications:

Hillary Clinton was born in **Chicago, Illinois**, United States on October 26, 1947

Donald Trump was born on June 14, 1946, in **Queens, New York City, New York**, United States

Michael Bloomberg was born on February 14, 1942, in **Boston, Massachusetts**, United States

Final Verification Response:

Here are some politicians who were born in NY, New York:

1. Donald Trump - former president of the United States
2. Alexandria Ocasio-Cortez - Democratic member of the U.S. House of Representatives
3. ...
4. ...

Task 1: Now try the chain of verification on two problem context you think of yourself:

Your Test #1:

Query:

Baseline Response:

Plan Verification:

Execute Verifications:

Final Verification Response:

Your Test #2:

Query:

Baseline Response:

Plan Verification:

Execute Verifications:

Final Verification Response:

Your reflections on Chain of Verification Prompting:

Task 2: Try the following prompt: “How many letter R in the word strawberry”

Think of different ways to conduct verification and Iterate as many times as needed to correctly count the number of times the letter 'R' appears in the word 'strawberry'. You can also try with “Raspberry”

Screenshot of Prompts/outputs

Analysis of strawberry task:

Submission Instructions:

After completing all the activities, fill the Google form and include a link to your copy of **this google document** on it. Make sure to set the document permissions so anyone can view it.

There is an optional activity below that you can complete if you have time.

Activity: Meta Prompting (Optional)

In this activity, you'll explore the concept of *meta prompting* by guiding an AI language model to create a prompt and then using the AI's generated prompt to produce a response. This iterative process helps you observe how the model constructs prompts and adapts them to create meaningful outputs.

Task:

1. **Prompt Generation:** Begin by asking the model to generate a detailed and creative prompt for a specific scenario or topic.
2. **Prompt Response:** Ask the model to respond to its own prompt, allowing you to evaluate how effectively it translates the generated prompt into an output.
3. **Iteration:** Experiment by modifying the original prompt slightly (changing a setting, character, or goal) and observe/write down how these changes impact the model's responses.

Reflection: Throughout each step, analyze the model's ability to create, interpret, and adapt prompts. Notice how well it maintains logical consistency, addresses complexity, and retains creativity.

Objective of Reflection: Consider discussing how the model's responses align with the elements introduced in the prompt. How effectively does the AI connect details and maintain coherence? Were there unexpected patterns in how the AI interpreted or responded to your prompt changes?

Step	Action	Example	Objective and Reflection
1. Generate a prompt by prompting the LLM	- Prompt the LLM to create a complex or creative prompt for a task	"Generate a writing prompt that involves a futuristic city, ancient magic, and a mystery to solve."	Understand how the model creates prompts based on specific input
2. Use the generated prompt	- Request the model to respond to the very prompt it just created	- Example Input: "Now, write a short story based on the prompt you just generated." - Expected Output: A short story expanding on the elements in the prompt, possibly detailing characters, world-building, and plot development based on the mysterious artifact in the futuristic city.	Objective: Evaluate how the LLM converts its own prompt into a response. Assess the creativity, depth, and coherence of the model's story in relation to the prompt.
3. Analyze the	Reflect on the interaction	Example: Reflect on how	Objective: Learn how well the

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process	between the generated prompt and the resulting story. compare the quality of the prompt to the quality of the output.	effectively the story utilized the concepts introduced in the original prompt (e.g., how the futuristic city setting influenced the story's plot,	model connects the context of the prompt with its response
4. Iteration	Modify the original prompt slightly and prompt the LLM again. Ask the model to create a new story based on a modified version of its first prompt.	Example Input: "Change the setting from a futuristic city to a medieval kingdom and regenerate the story." - Expected Output: A new short story set in a medieval world, now focusing on the same artifact but within a different cultural and technological context	Examine how the LLM handles iterative changes. - Reflection: Compare the new story to the original one. How well does the model adapt to alterations in the prompt?
Reflection.	analyze the LLM's performance throughout the process critically. Reflect on the LLM's creativity, logical consistency, and ability to handle complexity	- Discussion Prompts: "Why do you think the LLM focused on certain elements more than others?" "How did the change in prompt affect the model's response?" "Were there any unexpected patterns in how the LLM handled the tasks?"	- Reflection: Gain a comprehensive understanding of how the LLM processes prompts and how the model could be improved in terms of creativity, logic, or execution.

Prompt Images/Examples Section:

Analysis for Activity:

Your reflections