Topic: Prompt Engineering

Assignment 1: Zero-shot vs Few-shot Prompting

Step 1 – Understanding the Concepts

1. Zero-shot prompting

- **Definition:** Giving the AI only the question/task without any example.
- **Idea:** The model uses only its training knowledge to answer.
- **Example Task (Sentiment Analysis):**

Prompt: *"Determine if the following sentence is positive or negative: 'I love my new phone.'"*
The model will directly answer based on its understanding.

2. Few-shot prompting

- **Definition:** Giving the AI a few examples before the main question, so it understands the format or style of output you expect.
- **Idea:** Acts like a mini-training session right before answering.
- **Example Task (Sentiment Analysis):**
- Example 1: "I am happy today." → Positive
- Example 2: "I am sad today." → Negative
- Now classify: "The movie was amazing."

The model uses these examples to understand that your answers should be “Positive” or “Negative” and in the same style.

Step 2 – Assignment Example

Let’s choose **sentiment analysis** for a simple task.

Zero-shot Prompt

Prompt:

Determine if the following sentence is positive or negative: "I love my new phone."

Output from model:

Positive

Few-shot Prompt

Prompt:

Example 1: "I am happy today." → Positive

Example 2: "I am sad today." → Negative

Now classify: "I love my new phone."

Output from model:

Positive

Step 3 – Compare Outputs

Approach	Prompt Given	Model Output	Notes
Zero-shot	Only question	Positive	Model guessed based on prior training. Works fine for simple cases.
Few-shot	2 examples + question	Positive	More reliable, especially for complex tasks or when specific output format is required.

Step 4 – Observations

1. **Zero-shot** is quick and works well for common tasks (e.g., basic sentiment analysis, simple facts).
2. **Few-shot** improves accuracy and consistency, especially for:
    - Ambiguous cases
    - Complex instructions
    - Specific output formats (tables, step-by-step answers)

3. In this example, both worked because the sentence was simple, but for tricky sentences like *"The phone is fine, but battery life is terrible"*, few-shot often performs better.

Assignment 2:

Role-based vs Chain-of-Thought Prompting (Photosynthesis)

Objective: Learn role-based and step-by-step reasoning prompts and compare their effect on response style and clarity.

Task: Explain how photosynthesis works using two prompting styles.

Approach	Prompt	Model Output	Reflection
Role-based	You are a high school biology teacher. Explain photosynthesis to students in simple words. Cover: where it happens, what plants need, the main steps in simple terms, and why it matters. Use a short analogy and bullet points.	Simple teacher-style explanation: Think of a leaf as a tiny solar kitchen. Where it happens: In chloroplasts (green parts of leaf cells). What plants need: Sunlight, water (from roots), and carbon dioxide (from air). What they make: Sugar (glucose) for food and oxygen for the air. Main idea in two stages: • Light reactions (on the thylakoid membranes): sunlight energy splits water, releasing oxygen "bubbles," and makes energy packets (ATP and NADPH). • Calvin cycle (in the	Tone is friendly and accessible with an analogy and simple terms. Great for beginners, but it skips some chemical details.

		stroma): the plant uses ATP and NADPH to build sugar from carbon dioxide. Why it matters: It feeds the plant (and the whole food chain) and gives us oxygen while removing CO_2.	
Chain-of-Thought	Explain photosynthesis step by step, reasoning each step clearly. Describe inputs and outputs, the light reactions and the Calvin cycle, and end with the overall equation.	Step-by-step reasoning: 1) Inputs gathered: leaves take in CO_2 through stomata; roots bring water; sunlight reaches chlorophyll. 2) Light hits chlorophyll (PSII): water is split (photolysis) → electrons + H^+ + O_2 (oxygen is released). 3) Electron transport: energized electrons move along carriers, pumping H^+ to make a gradient that powers ATP synthase → ATP is produced. 4) PSI and NADPH: electrons are re-energized and reduce $NADP^+$ → NADPH (another energy carrier). 5) Calvin cycle: Rubisco fixes CO_2; with ATP and NADPH, 3-PGA → G3P; most G3P regenerates RuBP, some becomes glucose. 6) Outputs: glucose	Much more detailed and procedural. Improves scientific accuracy and clarity of mechanism, but longer and may feel heavy without prior vocabulary.

		(stored/used for energy and growth) and O_2 (released). 7) Overall balanced equation: $6CO_2 + 6H_2O$ + light → $C_6H_{12}O_6 + 6O_2$.	

Summary: Role-based prompting primarily shapes tone and audience fit, while chain-of-thought prompting shapes the structure and depth of reasoning. Choose based on your goal: quick, simple teaching vs. rigorous step-by-step clarity.