

Assignment: Role-based vs Chain-of-Thought Prompting

Introduction

The objective of this assignment is to compare role-based prompting and chain-of-thought prompting with respect to clarity, accuracy, and overall effectiveness of AI-generated responses. By applying both techniques to simple tasks, the study highlights their respective advantages and limitations, offering insights into how prompt design influences the quality of outputs.

Topic	Type	Prompt	Full Model Output	Reflection
A)Photosynthesis	Rolebased	"You are a high school biology teacher. Explain photosynthesis to students in simple words."	<i>Photosynthesis is the process by which plants convert carbon dioxide, water, and sunlight into food...</i> (repeated many times)	Role maintained (teacher style), but answer is very repetitive. Important points like glucose formation & oxygen release missing.
Photosynthesis	Chainof-Thought	"Explain photosynthesis step by step, reasoning each step clearly."	<i>Photosynthesis is the process of converting carbon dioxide, water, and oxygen into glucose...</i> (repeated many times)	Output shows stepwise attempt, but contains factual error (oxygen is not input, it's output).
B)Tennis Balls	Rolebased	"You are a friendly math teacher. Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. Explain to students how many tennis balls he has now in simple words."	<i>Roger has $5 + 2 = 7$... then $7 + 3 = 10$. The answer: 10.</i>	Teacher role followed, but arithmetic is wrong. Correct answer = 11.
Tennis Balls	Chainof-Thought	"Roger has 5 tennis balls. He buys 2 more cans of tennis balls."	<i>Roger buys 2 cans $\times 3 = 6$ cans... then $5 + 6 = 9$. The answer: 9.</i>	Attempted reasoning, but mistake in units
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		Each can has 3 tennis balls. Explain step by step, reasoning each calculation, to find out how many tennis balls he has now."		("6 cans" vs "6 balls"). Correct answer = 11.
C) Tea Making	Rolebased	"You are a cooking teacher. Explain to a beginner how to make a cup of tea in simple words."	<i>Fill a cup with boiling water and add a teaspoon of sugar. Bring the water to a boil, then add a teaspoon of cinnamon and a pinch of nutmeg...</i>	Clear recipe style explanation, but not realistic for normal tea (no mention of tea leaves/tea bag, milk etc.).
Tea Making	Chainof-Thought	"Explain how to make a cup of tea step by step, reasoning why each step is important."	<i>To make a cup of tea, you first need to gather your ingredients. Then you need to gather your tea leaves... then you need to gather your ingredients... (repeated many times).</i>	Shows attempt at stepwise detail, but suffers from heavy repetition and confusion. Needs correction for clarity.

Key Learnings:

- Role-based prompting makes outputs context-specific (e.g., teacher, chef, etc.).
- Chain-of-thought prompting improves stepwise reasoning.
- Both techniques can still give wrong or repetitive outputs.
- Prompt design directly impacts the quality of responses.

Recommendations

1. Always fact-check AI-generated outputs, especially for technical or numerical tasks.
2. Avoid vague wording in prompts to reduce ambiguity
3. Combine role-based and chain-of-thought approaches for balanced responses.
4. Iteratively refine prompts based on observed shortcomings.

