Prompt Engineering : A $\rightarrow$ Z

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Outline

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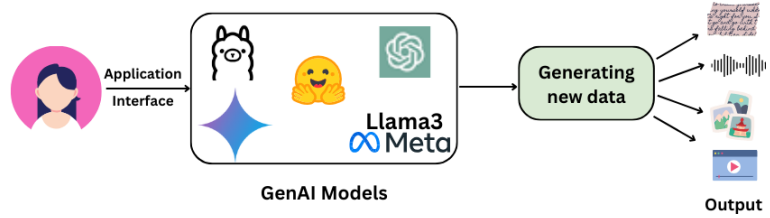
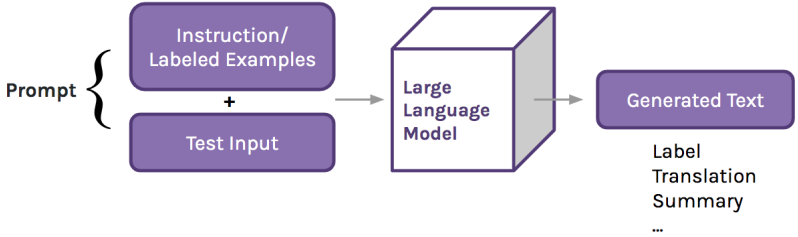
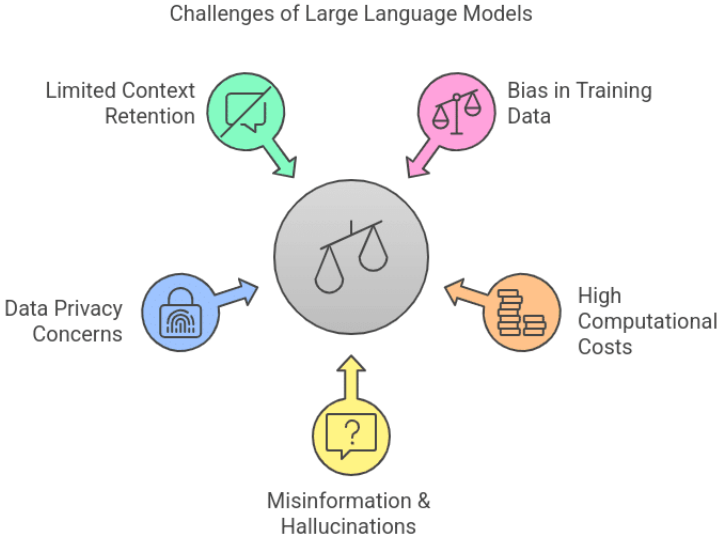
Introduction

Large Language Models





Challenges


Challenges of Large Language Models
Limited Context Retention
Bias in Training Data
Data Privacy Concerns
High Computational Costs
Misinformation & Hallucinations

Prompt and Prompt Engineering

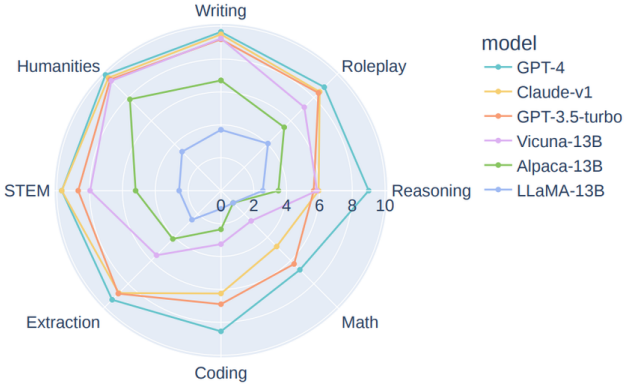
Prompt and Prompt Engineering

Prompt: A message you send to a GenAI

Prompt Engineering: The "science"
to send the exact right message
to get the output you want

Why Do We Need Prompt Engineering?

- AI models respond strictly to the **input they receive**.
- Vague prompts lead to **generic or incorrect outputs**.
- Well-designed prompts improve:
  - Accuracy
  - Relevance
  - Consistency
  - Proper tone and format
- Prompt engineering bridges the gap between **human intent** and **AI behavior**.



Prompt Component 1: Role

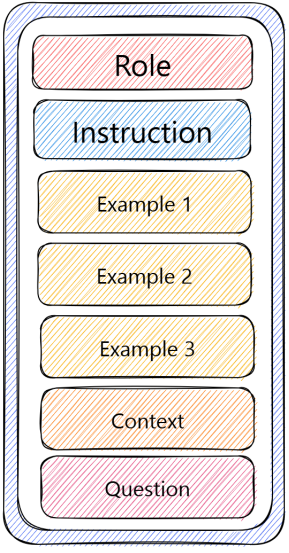
What is a Role?

The role defines **who the AI should act as**. It sets expertise, tone, and perspective.

- Shapes the style and depth of responses
- Helps align AI behavior with user intent
- Reduces generic or unfocused outputs

Example Role

You are an experienced university professor teaching AI to beginners.



Prompt Component 2: Instruction

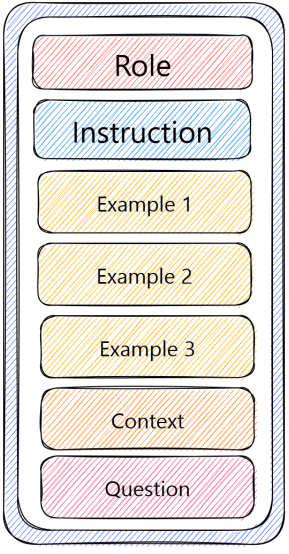
What is an Instruction?

The instruction specifies the **main task** the AI must perform.

- Should be clear, specific, and action-oriented
- Avoids ambiguity and irrelevant responses
- Can include constraints (length, format, tone)

Example Instruction

Explain prompt engineering in simple terms using real-life examples.



Prompt Component 3: Examples (Few-shot)

Why Examples Matter

Examples show the AI **how the output should look**. They guide structure, style, and reasoning.

- Improves consistency
- Reduces hallucinations
- Essential for complex or creative tasks

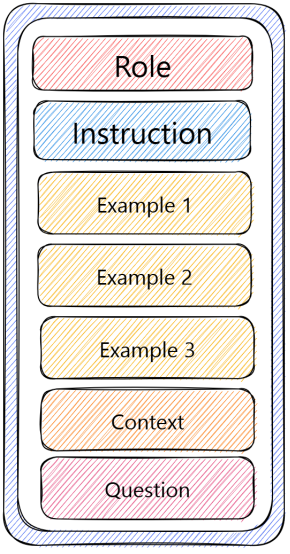
Example

Q: What is AI?

A: AI is the ability of machines to mimic human intelligence.

Q: What is ML?

A: ML is a subset of AI that learns from data.



Prompt Component 4: Context

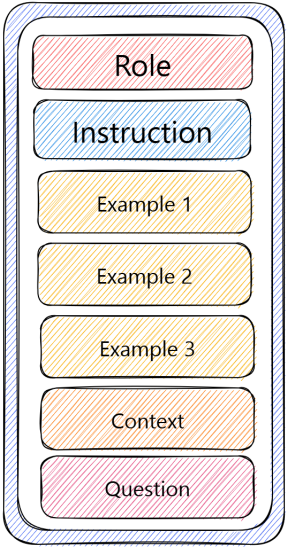
What is Context?

Context provides **background information, constraints, and assumptions** that help the AI tailor its response.

- Narrows down the response space
- Improves relevance and correctness
- Prevents overly generic answers

Example Context

This explanation is for first-year engineering students with no prior knowledge of AI.
Keep the explanation short and intuitive.



Prompt Component 5: Final Question / Answer

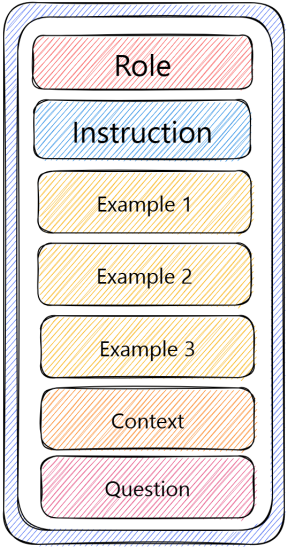
What is the Final Question?

This is the **exact request** you want the AI to respond to. It usually comes at the end of the prompt.

- Directs the AI to produce the final output
- Can specify format, length, or style
- Acts as the execution trigger

Example Final Question

Based on the above context and examples,
explain prompt engineering in 5 bullet points
using simple language.



Prompt Designs

Designing Prompts for Different Tasks

Tasks covered:

- Text Summarization
- Question Answering
- Text Classification
- Role Playing
- Code Generation
- Reasoning

Prompt Example: Text Summarization

Task

Condense a long text while preserving key ideas.

Prompt

```
Summarize the following article in 5 bullet points.
Focus on the main ideas and key conclusions.

Text:
[Paste the article here]
```

Prompt Example: Question Answering

Task

Answer questions based on given information.

Prompt

```
Using the information below, answer the question
clearly and concisely.

Context:
Photosynthesis is the process by which plants
convert sunlight into energy.

Question:
What is photosynthesis?
```

Prompt Example: Text Classification

Task

Assign a category or label to a piece of text.

Prompt

```
Classify the following review as
Positive, Negative, or Neutral.

Review:
"The product works fine, but delivery was slow."
```

Prompt Example: Role Playing

Task

Make the AI behave as a specific persona.

Prompt

```
You are a career counselor.

Advise a final-year engineering student
who is confused between higher studies
and taking up a job.
```

Prompt Example: Code Generation

Task

Generate executable code from a description.

Prompt

```
Write a Python function to check whether
a given number is prime.
Include comments in the code.
```

Prompt Example: Reasoning

Task

Solve a problem using logical, step-by-step reasoning.

Prompt

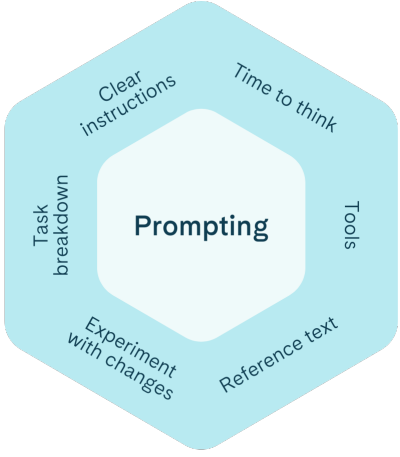
```
Solve the problem step by step and explain
your reasoning.

Problem:
If a shirt costs $20 after a 20% discount,
what was the original price?
```

Advanced Prompting Techniques

Advanced Prompting Techniques

"Quality of the prompt determines the usefulness and clarity of the AI's response."

- Anyone can craft effective prompts.
- Advanced prompting sets intent and context.
- Goal: reliable and controllable AI outputs.



Overview of Techniques

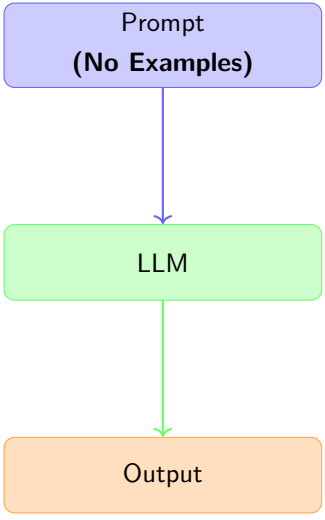
- Zero-shot Prompting
- Few-shot Prompting
- Chain-of-Thought
- Meta Prompting
- Self-Consistency
- Prompt Chaining
- Tree of Thoughts
- ReAct Prompting
- Reflexion
- Directional Stimulus Prompting
- Multimodal CoT
- Retrieval Augmented Generation

Zero-shot Prompting

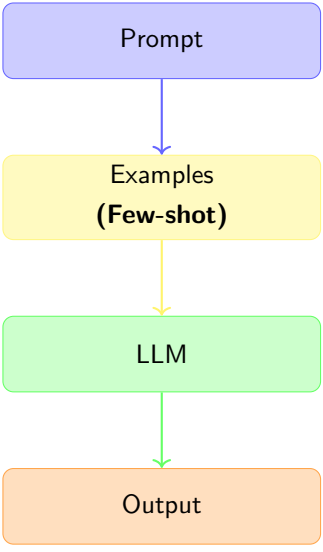
Concept

Ask the AI to perform a task without examples.

```
Summarize the following article in 100 words.
```



Few-shot Prompting



Concept

Provide a few examples and ask the AI to continue similarly.

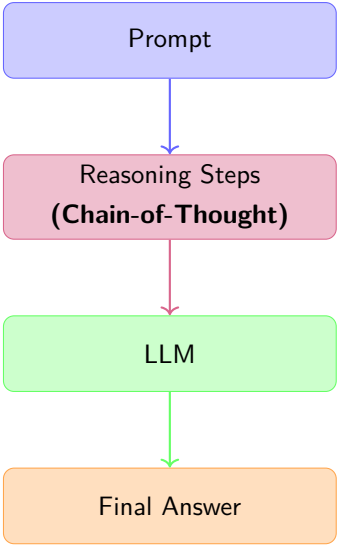
```
Examples:
- Save water, save life.
- Reduce waste, reuse today.

Now create 3 slogans for an eco-friendly product.
```

Chain-of-Thought Prompting

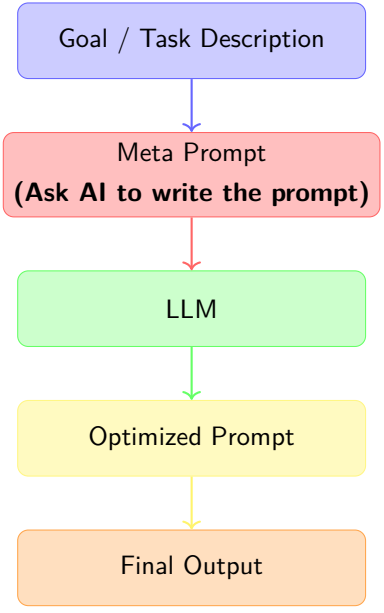
Concept

Encourage step-by-step reasoning before final output.

```
Solve the problem step by step.
Explain your reasoning clearly.
```



Meta Prompting



Concept

Ask AI how to design the best possible prompt.

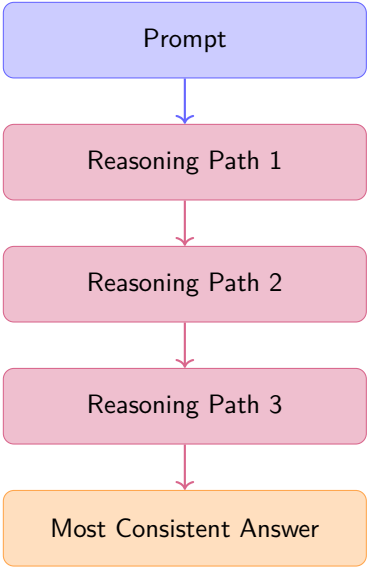
```
Suggest the best prompt to generate
high-quality biology quiz questions.
```

Self-Consistency Prompting

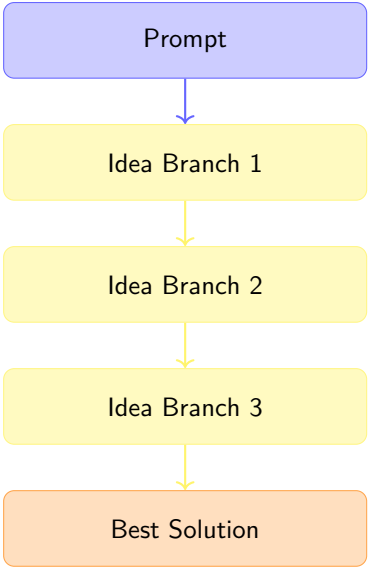
Concept

Ask the AI to generate multiple reasoning paths and select the most consistent or reliable answer.

```
Solve the problem three different ways.
Show each reasoning path clearly.
Select the answer that appears
most consistent across all solutions.

Problem:
A bat and a ball cost $1.10 in total.
The bat costs $1 more than the ball.
How much does the ball cost?
```



Tree of Thoughts Prompting



Concept

Ask the AI to explore multiple possible solution branches before deciding on the best one.

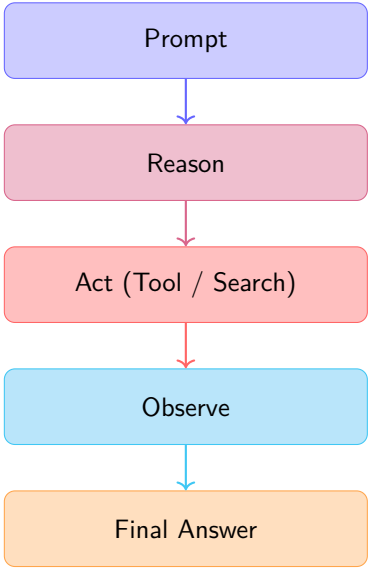
```
Generate multiple possible solutions.
Evaluate the pros and cons of each.
Choose the best approach.

Problem:
How can a city reduce traffic congestion?
```

ReAct (Reason + Act) Prompting

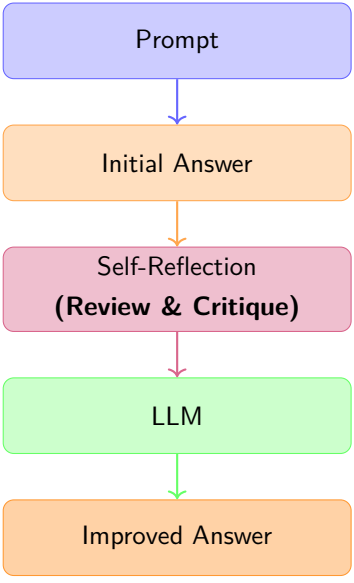
Concept

The AI alternates between reasoning and taking actions (such as searching or calculating) before answering.

```
Think step by step about the problem.
Decide when to take an action (search,
    calculate).
Use the observation to refine reasoning.
Repeat until ready to answer.

Question:
Who is the Prime Minister of India
and what is the square of their age?
```



Reflexion



Concept

Ask the AI to review and improve its own answer.

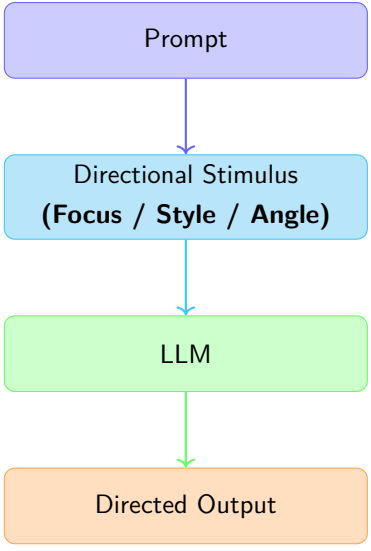
```
Solve the problem.
Reflect on reasoning.
Correct mistakes.
Provide final answer.
```

Directional Stimulus Prompting

Concept

Guide the AI toward a specific focus or audience.

```
Explain Newton's Laws
for 5th graders
using simple examples.
```

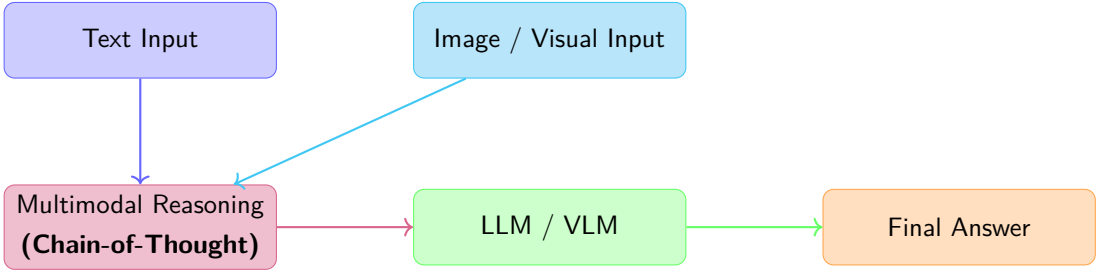


Multimodal Chain-of-Thought

Concept

Reason across text, images, and other modalities.

```
Look at the image and explain the trend using visual cues.
```

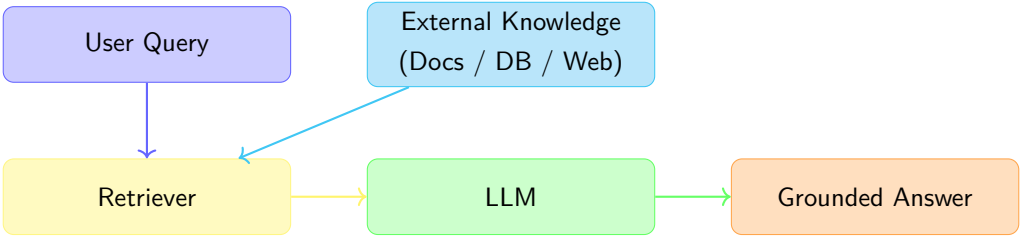


Retrieval-Augmented Generation (RAG)

Concept

Ground AI responses using external documents.

```
Using the provided document, answer accurately without hallucination.
```



Conclusion

Key Takeaways

- Prompt engineering is a **structured design process**, not trial-and-error.
- The quality of AI output is strongly determined by **role, instruction, examples, context, and final query**.
- Different tasks require **different prompt strategies** (summarization, QA, classification, reasoning, code).
- Advanced prompting techniques enable **better reasoning and control**:
  - Chain-of-Thought
  - Self-Consistency
  - Tree of Thoughts
  - ReAct and Reflexion
- Multimodal prompting allows AI to **reason across text and visuals**.
- RAG grounds AI responses in **external knowledge**, reducing hallucinations.
- Prompt engineering is becoming a **core skill** for working with modern LLMs, agents, and AI systems.

Conclusion

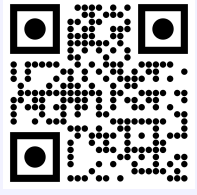
- Prompt engineering is not trial-and-error, but a **systematic design process**.
- Well-structured prompts translate **human intent into reliable AI behavior**.
- Advanced techniques such as:
  - Chain-of-Thought
  - Self-Consistency
  - Tree of Thoughts
  - ReAct and Reflexion

  enable deeper reasoning and better control.
- As AI systems evolve toward **agentic and multimodal models**, prompt engineering becomes a **core skill**.

Thank You!

For your attention and participation !!!

Dr. Shailesh Sivan



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