

# Essentials of Generative AI, Prompt Engineering, and ChatGPT



# Prompt Engineering



# Learning Objectives

By the end of this lesson, you will be able to:

- 🕒 Recognize the role of prompt design in optimizing ChatGPT's performance
- 🕒 Explain the elements of a structured prompt
- 🕒 Apply basic prompt engineering techniques for desired responses
- 🕒 Utilize task-specific prompt strategies for accurate outputs

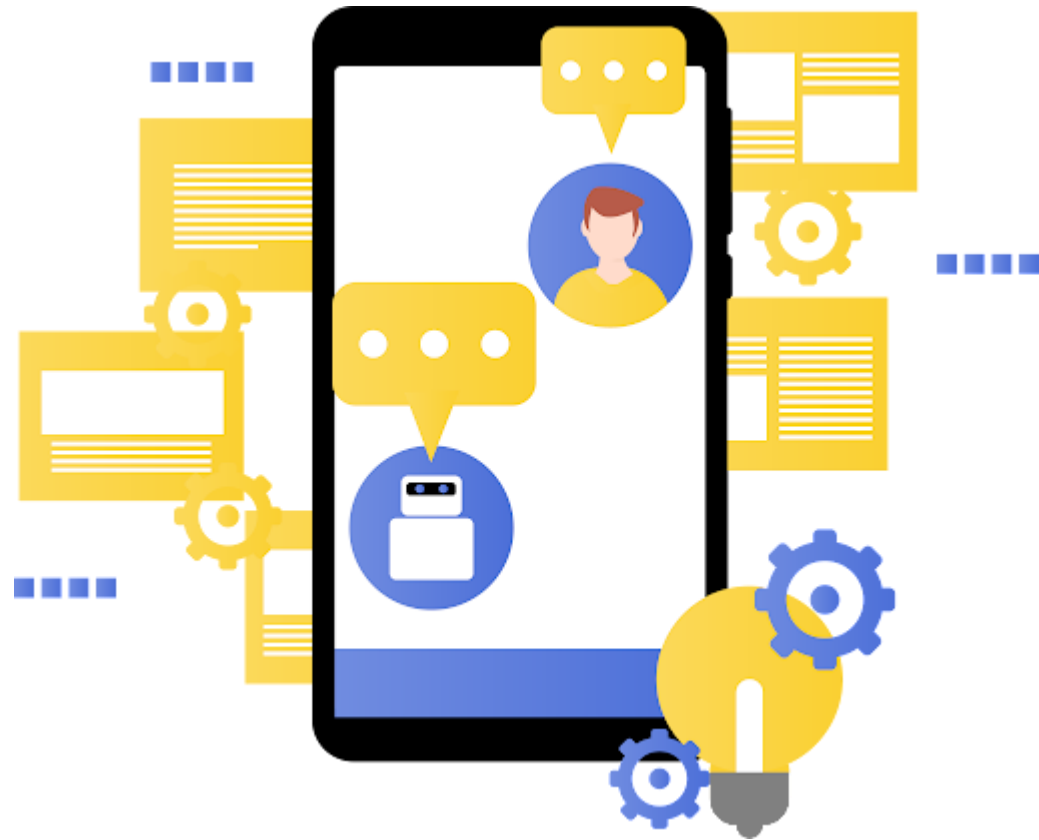




# **Prompt Engineering and Its Importance**

# Prompt Engineering

Prompt engineering refers to the process of crafting and designing effective prompts or instructions to guide language models, such as ChatGPT, in generating desired outputs.



It involves formulating clear and specific instructions, providing relevant context, structuring examples, and leveraging system messages to influence the behavior and response quality of the model.

# Prompt Engineering

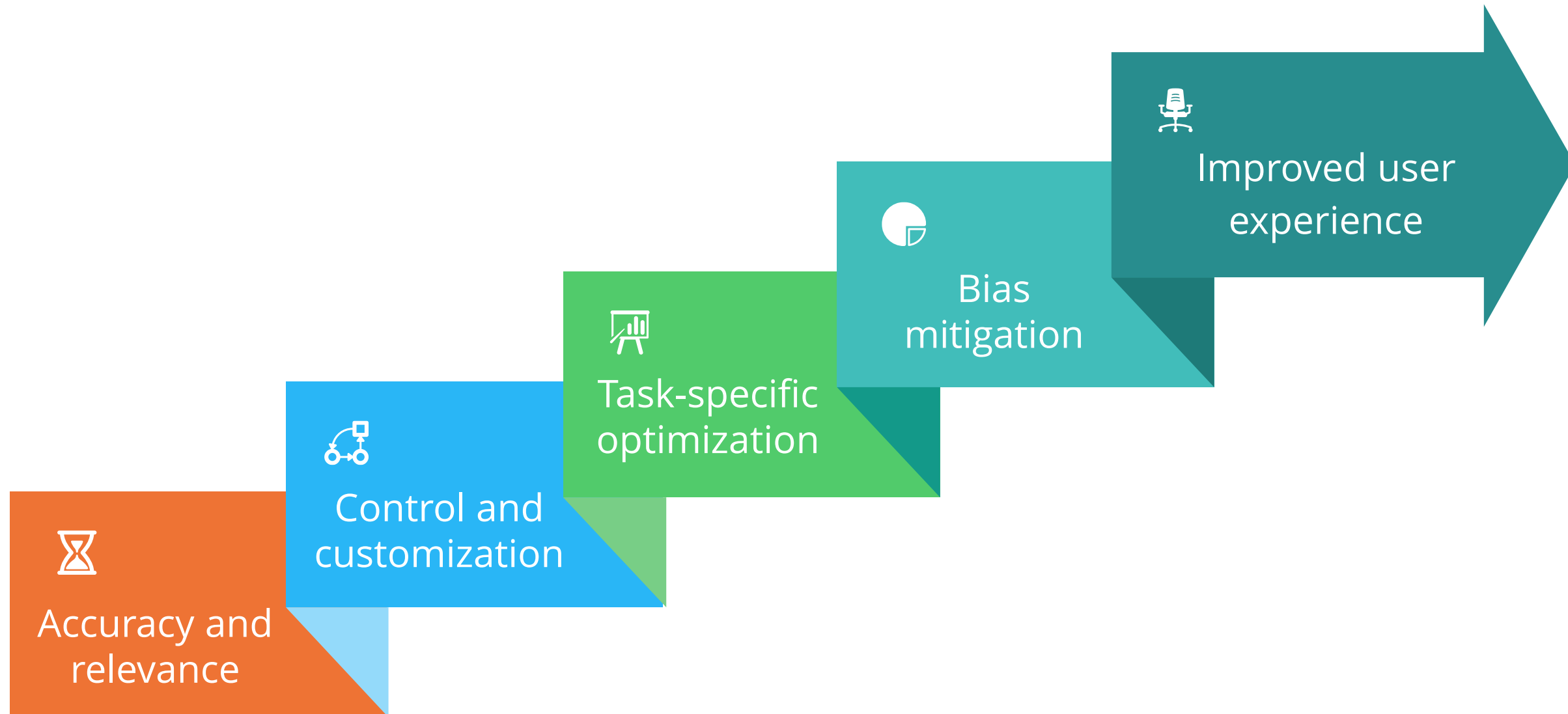
The goal of prompt engineering is to optimize the performance of language models.



- It refines language model outcomes with careful prompt construction.
- It enhances accuracy, relevance, and coherence, extending benefits to tasks like summarizing and answering questions.
- It requires understanding prompt architecture, guiding model behavior, and continuous refinement of prompts.

# Importance of Prompt Engineering

Prompt engineering plays a critical role in optimizing the performance of language models, leading to several key advantages:



# Prompt Engineering: Example



Answering questions

## Prompt:

What are the symptoms and treatment options for COVID-19?

## Prompt response:

The model generates accurate and comprehensive information about COVID-19 symptoms and treatment, providing valuable insights for users.



# Prompt Engineering: Example

## Prompt:

Concisely summarize the article on renewable energy sources

## Prompt response:

The model generates a concise and coherent summary that captures the article's key points, making it easier for users to grasp the main ideas quickly.



Summarizing content

# Prompt Engineering: Example



Language translation

## Prompt:

Translate the following English text into French: The cat is sitting on the mat.

## Prompt response:

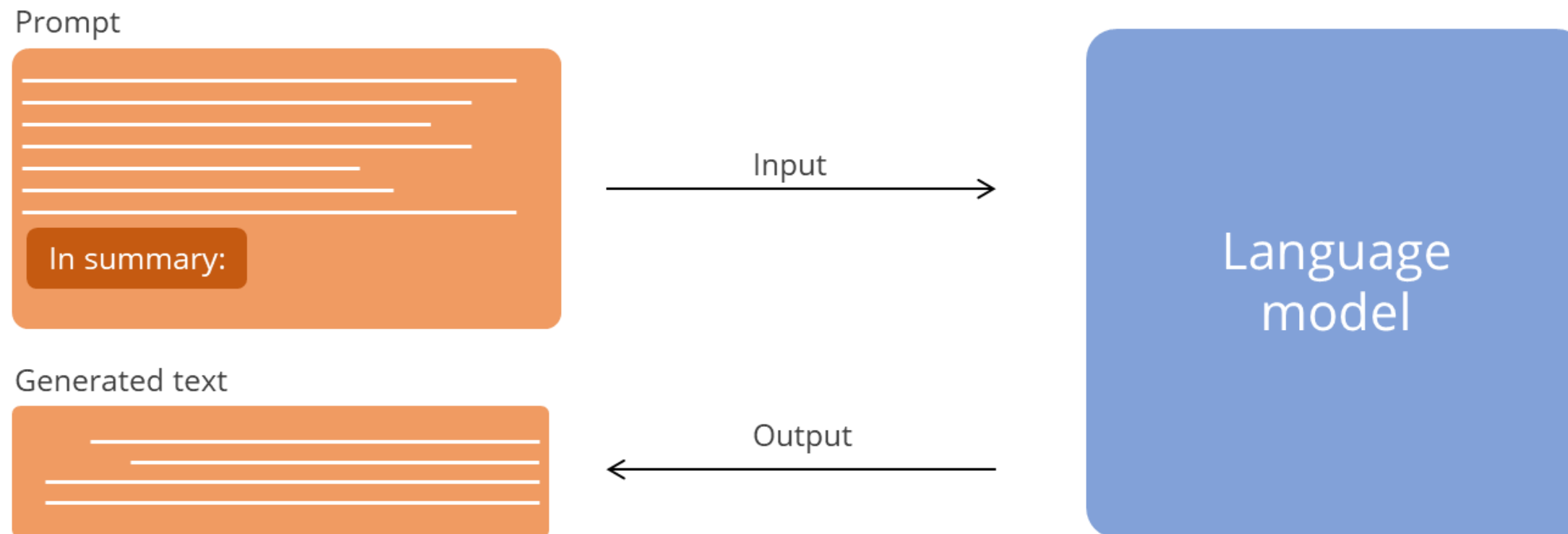
The model accurately translates the English text into French, ensuring an effective and reliable communication tool for users.



## **Basic Architecture and Components of a Prompt**

# Basic Architecture and Components of a Prompt

The basic architecture of a prompt consists of several key components that work together to guide the behavior and output of a language model.



# Basic Architecture and Components of a Prompt

Here are the main components:

## **Context:**

- The context provides background information or preceding dialogue that helps set the stage for the model's response.
- It helps the model understand the conversation or the specific task at hand, ensuring continuity and coherence in the generated output.

## **Instructions:**

- Instructions are explicit guidelines or directives given to the model to guide its behavior.
- They specify the desired outcome, format, or constraints for the response.
- Clear and specific instructions help shape the model's understanding and generate more relevant and accurate outputs.

# Basic Architecture and Components of a Prompt

Here are the main components:

## System messages:

- Utilize additional texts or prompts as intermediary instructions or clarifications
- Offer context, guidance, or information to the model, without significantly influencing the final response

## Examples:

- Utilize specific instances as demonstrations for the model to emulate
- Provide concrete references to guide the model toward desired patterns or behaviors

# Importance of Clear And Specific Instructions





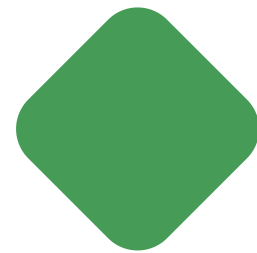
# **Basic Prompt Engineering with ChatGPT**



# Strategies for Formulating Effective Prompts

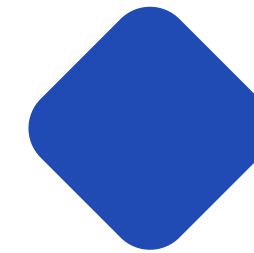
Formulating effective prompts is essential for guiding language models to generate accurate and relevant responses.

Here are some strategies to consider when crafting prompts:



## **Be clear and specific**

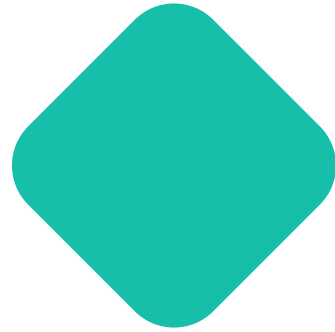
Communicate desired output or task to the model



## **Provide context**

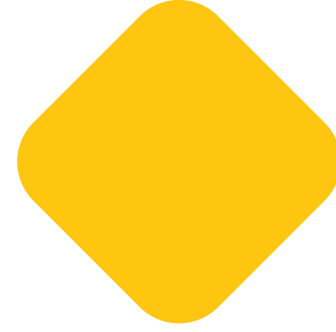
Set the context by providing relevant information or preceding dialogue

# Strategies for Formulating Effective Prompts



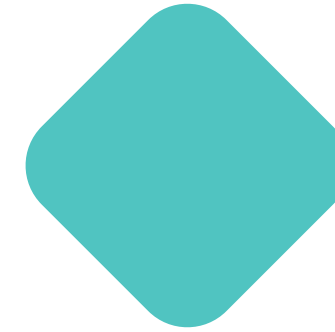
## Use examples

Include specific examples or demonstrations of the desired output



## Consider length and detail

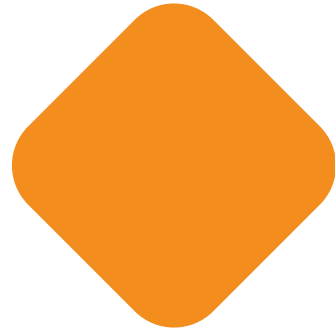
Determine the desired length and level of detail for the response



## Control style and tone

Provide explicit instructions to the model when specific requirements exist for style, tone, or level of formality

# Strategies for Formulating Effective Prompts



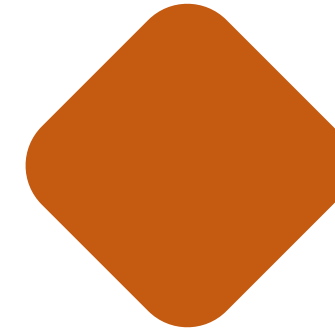
## Anticipate limitations

Consider the limitations of the language model and anticipate potential pitfalls or challenges



## Iterative refinement

Engage in prompt engineering through an iterative process of refinement, experimenting with different variations of prompts, analyzing the model's responses, and adjusting accordingly



## Test and validate

Evaluate the model's responses against the expectations and validate the effectiveness of the prompts by analyzing the quality, accuracy, and relevance of the generated output

# Generating Prompts

The choice of prompt generation depends on:



Specific requirements  
of the task



Available resources



Desired level of  
computation

- Manual prompt crafting enables control and customization, while automated techniques ensure efficiency and scalability.
- A combination of these techniques is used to leverage the strengths of each and achieve optimal prompt design.

# Techniques for Generating Prompts

Generating effective prompts is a critical aspect of prompt engineering.

Various techniques that can be employed to create prompts that guide model behavior are:



Manual prompt  
crafting



Template-based  
generation



Rule-based  
systems

# Manual Prompt Crafting

Manual prompt crafting involves the manual creation of prompts by domain experts or researchers.



It requires a deep understanding of the task and the desired model behavior.



Prompt design carefully considers the task requirements, desired output, and potential model biases.



This technique allows for fine-tuning based on specific variations and user feedback.



It offers high-level control and customization over the prompt design process.

# Manual Prompt Crafting: Example

An example of a manual prompt is given below:

Prompt: You are a software engineer tasked with debugging the following code

Code Snippet:

```
def calculate_average(numbers):  
    sum = 0  
    count = 0  
  
    for num in numbers:  
        sum += num  
        count += 1  
  
    average = sum / count  
    return average  
  
# Test the function  
numbers = [5, 7, 3, 9, 2]  
result = calculate_average(numbers)  
print("The average is:", result)
```

# Template-Based Generation

Template-based generation involves defining prompt templates with placeholders for task-specific information.



Templates may incorporate specific instructions, context, or sample inputs.



Prompt generation fills placeholders with relevant content, such as task-specific keywords or data samples.



Design of templates can utilize patterns observed in the task, input-output structures, or user preferences.



Automation of prompt generation, while still allowing flexibility and customization, is made possible by this technique.



# Template-Based Generation: Example

An example of a template-based prompt is given below:

Template:

"Classify the following text into one of the categories: [CATEGORY1], [CATEGORY2], or [CATEGORY3]."

Generated Prompt:

"Classify the following text into one of the categories: sports, technology, or politics."

In this example, the template-based approach utilizes a predefined template structure with placeholders for the specific task-related information. The template includes the instruction to classify the text into one of the provided categories. The placeholders [CATEGORY1], [CATEGORY2], and [CATEGORY3] indicate where the actual category options would be filled in.

# Rule-Based Systems

Rule-based systems utilize predefined rules or heuristics to generate prompts.



The rules can be based on linguistic patterns, semantic relationships, or statistical analysis of the data.



The system applies the rules to generate prompts based on certain criteria or guidelines.



The rule-based prompt generation guarantees consistency and systematic creation of prompts.



This technique is particularly useful when prompt variations need to adhere to specific rules or guidelines.

# Rule-Based Systems: Example

Rule:

"If the input text has more than [MAX\_LENGTH] words, generate a summary by extracting the key sentences. Otherwise, generate a summary by condensing the main points into a concise paragraph."

Generated Prompt:

"If the input text has more than 100 words, generate a summary by extracting the key sentences. Otherwise, generate a summary by condensing the main points into a concise paragraph."

- In this example, rule-based prompt generation relies on predefined rules or criteria for prompt structure based on input text characteristics.
- A rule is set to determine the appropriate prompt structure based on word count.
- If input text exceeds a specific word count (in this case, 100 words), key sentences are extracted for the summary.
- For shorter texts, the main points are condensed into a concise paragraph for the summary.



# Prompting ChatGPT

# Prompting ChatGPT: Q&A

The following provides instructions for how to prompt ChatGPT in a Q&A format:

1

Explicitly state the question

2

Provide necessary context

3

Format the prompt as a conversation

4

Restrict the answer length

5

Fine-tune the prompt

6

Ask for reasoning or an explanation

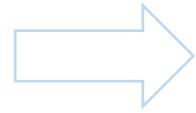
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Iterate and evaluate

# Prompting ChatGPT: Q&A

## Example: Accurate prompts

**User:**



Can you explain the concept of gravitational force?

**Assistant:**



Sure! The concept of gravitational force is a fundamental concept in physics.

**User:**



What are the main factors influencing climate change?

**Assistant:**



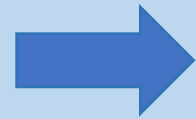
The main factors influencing climate change include many reasons.

# Prompting ChatGPT: Q&A

Suppose one wants to know about Neuroscience

## Inaccurate prompt

**User:**



What can you tell me about science?

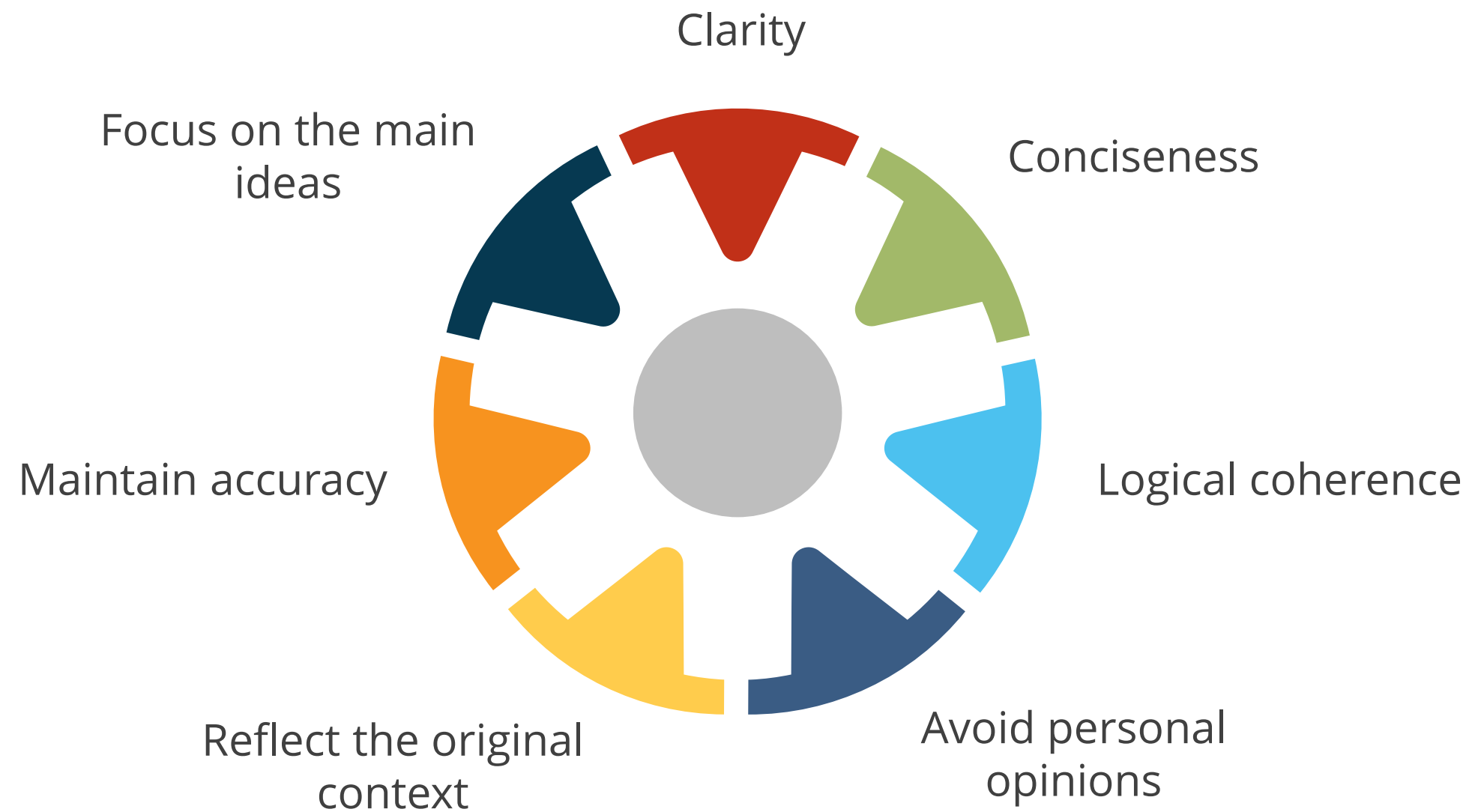
**Assistant:**



Science is a systematic approach to understanding the natural world, involving observation, hypothesis formulation, and experimental verification.

# Prompting ChatGPT: Summarize

Here are a few guidelines on how to engage ChatGPT in summarization tasks:





# Prompting ChatGPT: Summarize

## **Clarity:**

Maintain clarity in the summary by using simple, direct language

## **Conciseness:**

Keep the summary concise by capturing the principal ideas or crucial information succinctly

## **Logical coherence:**

Structure the summary logically, ensuring a smooth flow and easy comprehension for the reader

## **Avoid personal opinions:**

Preserve objectivity in the summary, avoiding the inclusion of personal opinions or interpretations unless explicitly required

# Prompting ChatGPT: Summarize

## **Reflect the original context:**

- Capture the essence and context of the original content in the summary
- Preserve the overall meaning and purpose during the condensation of information

## **Maintain accuracy:**

- Retain the accuracy and integrity of the original content when condensing
- Avoid distortion or misrepresentation of facts or ideas

## **Focus on the main ideas:**

- Identify and prioritize the most crucial concepts, events, or arguments in the summary.
- Exclude minor details or peripheral information

# Prompting ChatGPT: Summarize

## Accurate prompts

**Prompt:** Can you provide a brief summary of the plot of the movie Inception?

**Prompt:** Please summarize the main events of the American Revolutionary War.

**Prompt:** In a few sentences, summarize the key features of the latest iPhone model.

## Inaccurate prompt

**Prompt:** Please summarize the entire field of quantum physics in one sentence.

# Prompting ChatGPT: Explain

Here are a few guidelines on how to engage ChatGPT in explanation tasks:

## Structure

- Present information logically and in sequential order
- Use headings or bullet points for key aspects

## Context

Provide relevant context or background information to set the stage for the explanation

## Clarity

Ensure that the explanation is clear and easy to understand

## Use examples

Illustrate the concept or idea with examples to make it more tangible and relatable

# Prompting ChatGPT: Explain

## Avoid assumptions

Start from a foundational level and build up the explanation, ensuring the coverage of all essential information

## Accuracy

Verify information from reliable sources and double-check technical details or factual claims before the presentation

## Provide depth

Tailor the depth of the explanation to the intended audience or context, avoiding unnecessary complexity or oversimplification

## Answer potential questions

Anticipate common questions or points of confusion and proactively address them in the explanation, clarifying potential areas of uncertainty

# Prompting ChatGPT: Explain

## Accurate prompts

**Prompt:** Can you explain the concept of artificial intelligence?

**Prompt:** Please provide an explanation of the process of cellular respiration.

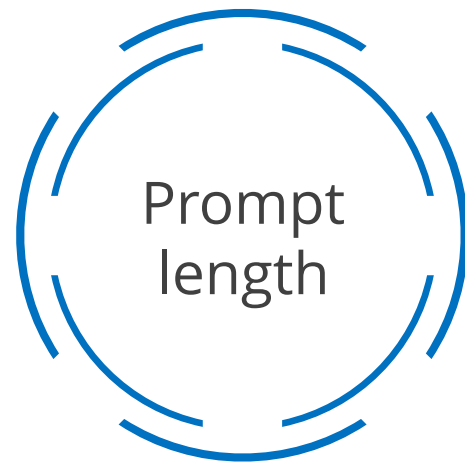
**Prompt:** In a few sentences, explain the principles of supply and demand in economics.

## Inaccurate prompt

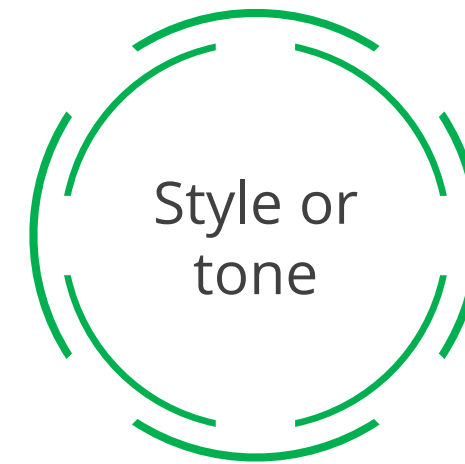
**Prompt:** Please explain the entire field of mathematics in one sentence.

# Prompting ChatGPT: Completion

Here are a few guidelines on how to engage ChatGPT in completion tasks:



Indicate the desired length or format, whether a word, sentence, or paragraph



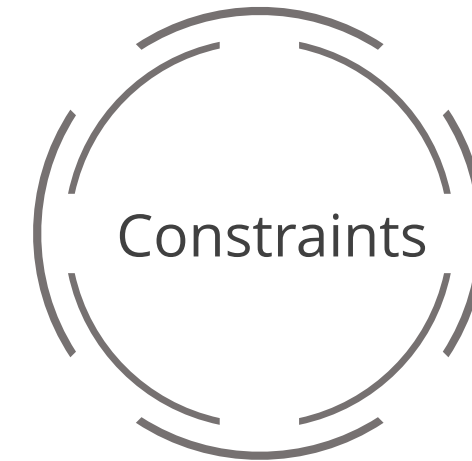
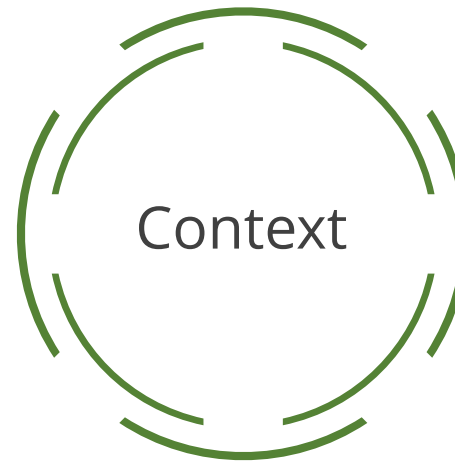
Direct the model to maintain a specific style, tone, or voice for consistency

# Prompting ChatGPT: Completion



- Use iterative prompts for desired outcomes
- Adjust prompt wording or context, as necessary

Supply ample context for completion tasks, incorporating necessary information or preceding text



Define constraints or requirements clearly, instructing the model on topics, themes, or narrative direction



# Prompting ChatGPT: Completion

The right prompt precisely conveys what needs to be done, while the wrong prompt tends to be generalized and fails to provide proper instruction.

## Accurate prompt

**Prompt:** Complete the following sentence: In a galaxy far, far away, \_\_\_\_\_.

**Prompt:** Please provide the continuation for the sentence: In a galaxy far, far away, \_\_\_\_\_.

## Inaccurate prompt

**Prompt:** Write a novel about a detective solving a mysterious crime.

# Prompting ChatGPT: Translation

Here are a few guidelines on how to engage ChatGPT in translation tasks:

## 1 Language pair

Prioritize conveying the original meaning, mindful of linguistic and cultural nuances

## 2 Clarity

Include all relevant context and information to facilitate the translation process

## 3 Context

Ensure translations are clear, fluent, and grammatically correct

## 4 Accuracy

Specify both the source language and the target language clearly

# Prompting ChatGPT: Translation

## Accurate prompt:

**Prompt:** Translate the following sentence into Spanish: I love to travel and explore new cultures.

**Prompt:** Please translate the sentence I love to travel and explore new cultures into Spanish.

## Inaccurate prompt:

**Prompt:** Please translate the entire document from English to French.



## **Best Practices, Considerations, and Limitations**

# Best Practices and Considerations

Best practices and considerations for using ChatGPT effectively:

## Clearly define the goal

Determine the purpose of using ChatGPT and clearly define your objective

## Be mindful of bias

Carefully review and evaluate the outputs to ensure fairness and mitigate potential biases

## Iterate and refine

Experiment with different prompts and iterate on them to achieve the desired results

# Best Practices and Considerations

## **Use system messages strategically**

System messages can offer additional context or instructions to guide the model's behavior

## **Responsible use**

When using ChatGPT, be mindful of ethical considerations

## **Verify information independently**

Always verify critical information from reliable sources even though ChatGPT provides useful insights

# Limitations of ChatGPT

It is important to be aware of the limitations and exercise critical thinking and caution when interpreting and relying on ChatGPT's responses.

## Lack of common sense

- It may generate responses that sound plausible but are factually incorrect or lack common sense reasoning.
- It does not possess inherent knowledge or understanding beyond what it has been trained on.

## Sensitivity to input phrasing

- The way a prompt is phrased can significantly influence the model's response.
- Minor changes in wording can lead to different outputs, making it important to carefully craft prompts to achieve desired results.

# Limitations of ChatGPT

## Overuse of generic responses

- It tends to produce generic or safe responses, especially when it is uncertain about the specific context or lacks sufficient information.
- This can sometimes result in uninformative or evasive answers.

## Sensitivity to bias

- Language models like ChatGPT can inadvertently reflect biases present in the training data.
- It may reinforce biases, stressing the importance of careful prompt engineering and evaluation.

## Inability to ask clarifying questions

- ChatGPT lacks the ability to seek clarifications or ask follow-up questions when the input is ambiguous or requires further context.
- It may generate responses based on incomplete or misunderstood information.



# Limitations of ChatGPT

## Difficulty in handling abstractions

- ChatGPT may struggle with abstract concepts or reasoning beyond its training data.
- It may provide overly simplistic or nonsensical responses when faced with complex or abstract queries.

## Inconsistent responses

- The model's responses can be sensitive to slight changes in the prompt or the ordering of information.
- It may provide different answers for similar queries, leading to inconsistent behavior.

# Limitations of ChatGPT

## Limited knowledge and outdated information

- ChatGPT's training data is current up to September 2021.
- It may lack awareness of recent events or advancements beyond that time, potentially providing outdated or inaccurate information.

## Dependency on training data

- The performance of ChatGPT heavily relies on the quality and diversity of the data it has been trained on.
- It may struggle with topics or domains that were underrepresented in its training data.

## Lack of emotional understanding

- ChatGPT lacks emotional understanding or empathy.
- It may not respond appropriately to emotionally charged or sensitive queries, potentially leading to inappropriate or insensitive responses.



## Group Activity

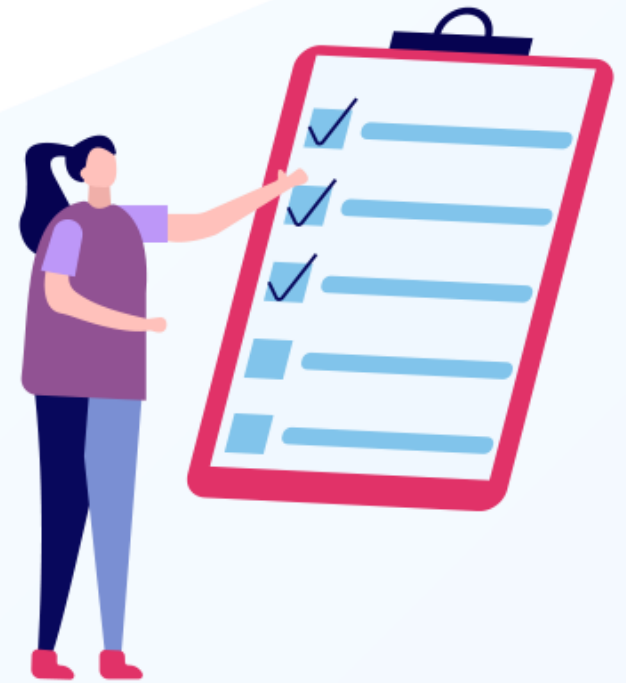
# Group Activity: Mastering Prompt Engineering

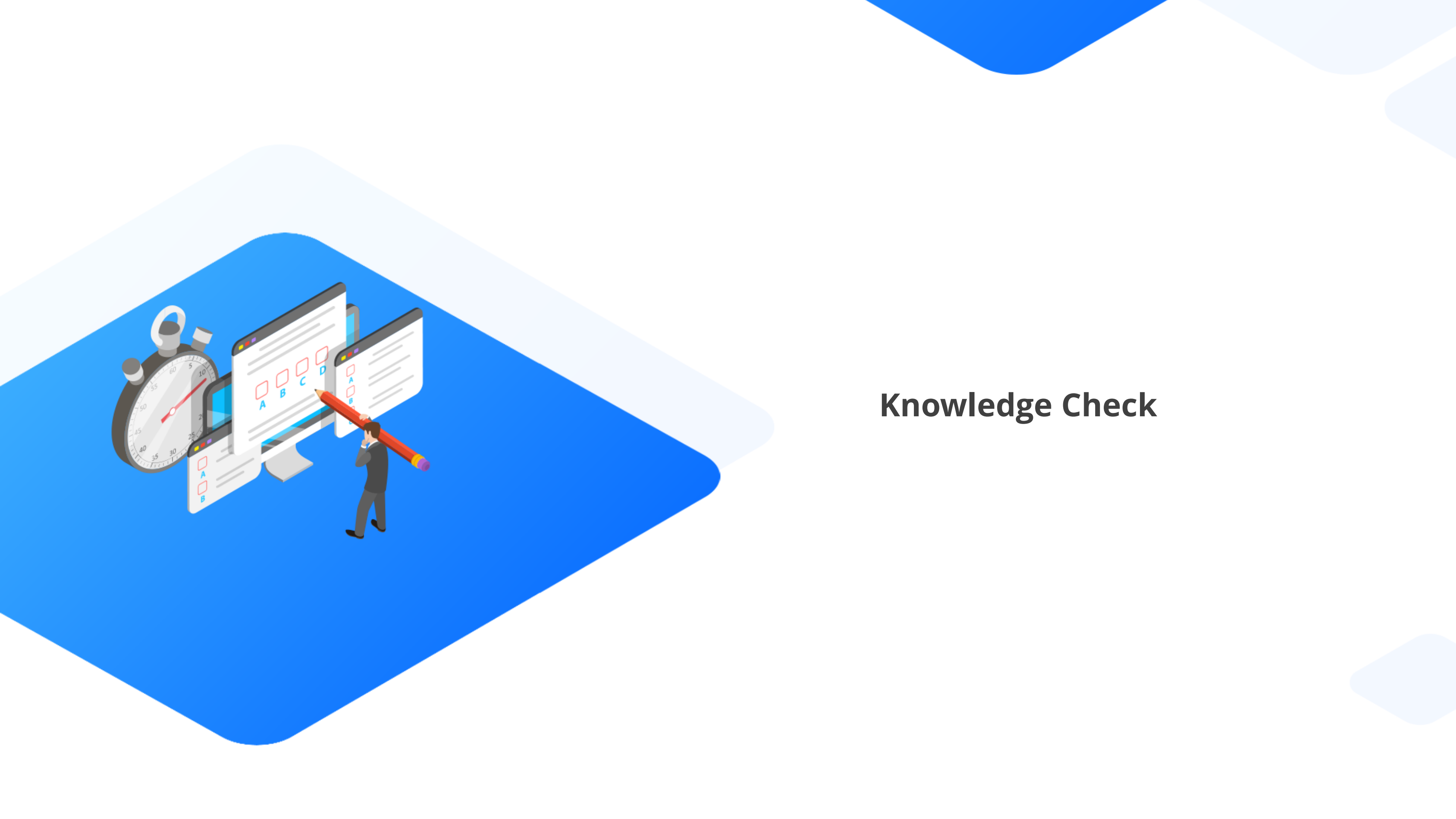
1. Get into your respective breakout rooms.
2. Pick one situation from the following: asking for help from customer service, getting educational information, or getting help with writing creatively.
3. Draft a prompt that best describes your desired output.
4. Use ChatGPT for this exercise.
5. Analyze the generated output with your group.
6. Come back to the main Zoom room to present your output and the chosen prompt.
7. Discuss the prompt in class and see how each group's prompt differs.

**Remember:** Your aim is to see how your descriptive prompts influence the AI's visual output.

# Key Takeaways

- Prompt engineering refers to the process of crafting and designing effective prompts or instructions to guide language models, such as ChatGPT, in generating desired outputs.
- The right prompt precisely conveys what needs to be done, while the wrong prompt tends to be generalized and fails to provide proper instruction.
- The basic architecture of a prompt consists of several key components that work together to guide the behavior and output of a language model.
- It is important to be aware of the limitations and exercise critical thinking and caution when interpreting and relying on ChatGPT's responses.





## Knowledge Check

## Knowledge Check

1

**What is the role of prompt design in prompt engineering?**

- A. Enhancing model performance
- B. Controlling model behavior
- C. Improving training data quality
- D. Adjusting computational resources



## Knowledge Check

1

What is the role of prompt design in prompt engineering?

- A. Enhancing model performance
- B. Controlling model behavior
- C. Improving training data quality
- D. Adjusting computational resources

---

The correct answer is **A**

---

**Prompt engineering is used to enhance model performance.**





## Knowledge Check

2

**Which component is NOT a part of the basic architecture of a prompt-based system?**

- A. Context
- B. Instructions
- C. Examples
- D. Output generation



## Knowledge Check

2

Which component is NOT a part of the basic architecture of a prompt-based system?

- A. Context
- B. Instructions
- C. Examples
- D. Output generation

---

The correct answer is **D**

---

**Output generation is not a part of the basic architecture of a prompt-based system.**



## Knowledge Check

3

**Why are clear and specific instructions important in guiding the model's behavior?**

- A. They prevent biases in responses.
- B. They improve model training speed.
- C. They ensure faster response times.
- D. They help achieve accurate and relevant outputs.



## Knowledge Check

3

Why are clear and specific instructions important in guiding the model's behavior?

- A. They prevent biases in responses.
- B. They improve model training speed.
- C. They ensure faster response times.
- D. They help achieve accurate and relevant outputs.



---

The correct answer is **D**

---

**Clear and specific instructions help achieve accurate and relevant outputs.**

## Knowledge Check

4

**Which task can be accomplished through prompt engineering with ChatGPT?**

- A. Image classification
- B. Sentiment analysis
- C. Language translation
- D. Speech recognition



## Knowledge Check

4

Which task can be accomplished through prompt engineering with ChatGPT?

- A. Image classification
- B. Sentiment analysis
- C. Language translation
- D. Speech recognition

---

The correct answer is **C**

---

**Prompt engineering with ChatGPT can accomplish language translation.**





**Thank You!**