

Few-shot prompting

CHATGPT PROMPT ENGINEERING FOR DEVELOPERS

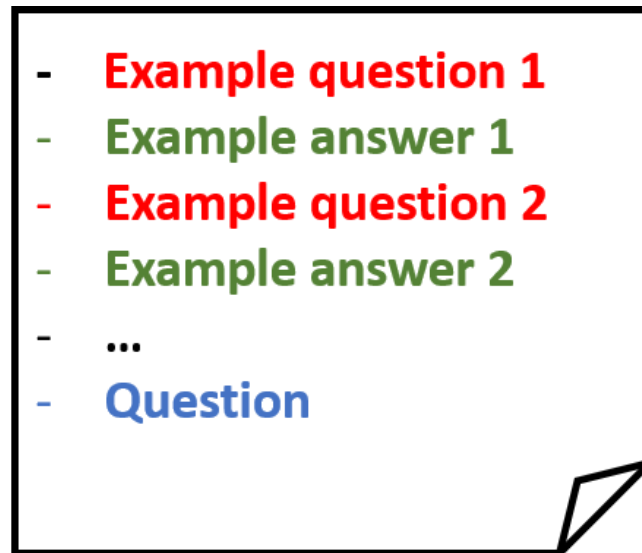


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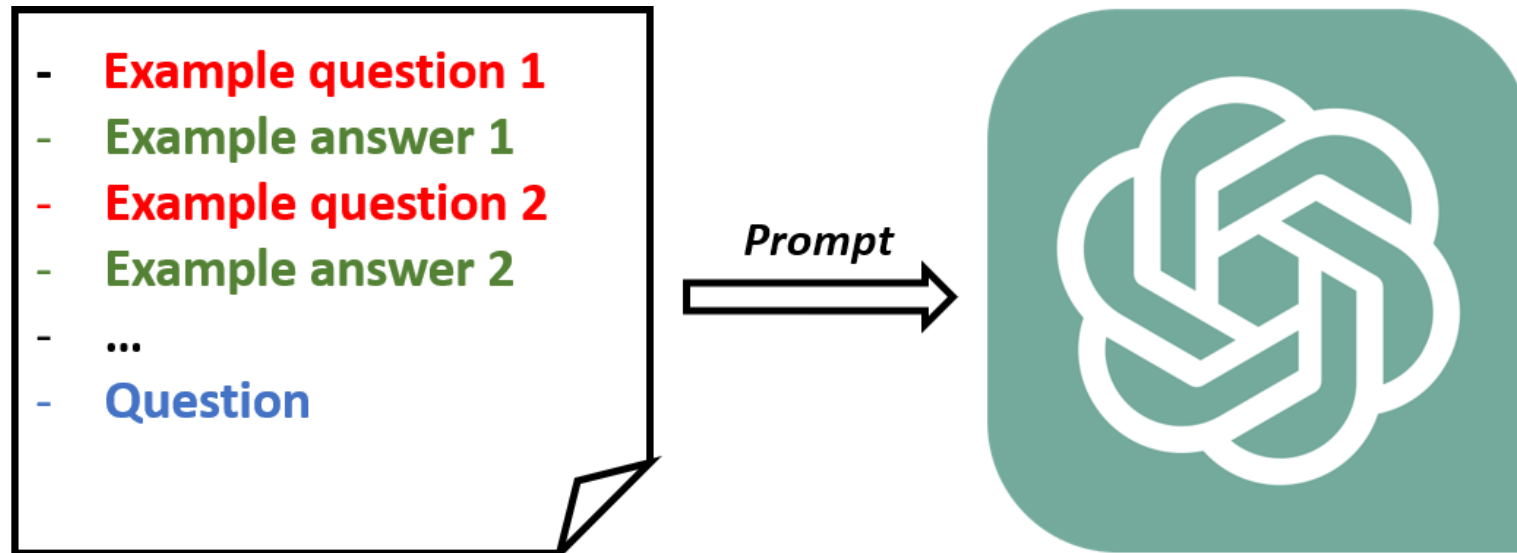
Few-shot prompting

- Model provided with examples (question-answer pairs)



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Few-shot prompting

- Model provided with examples (question-answer pairs)



Few-shot prompting

- Model provided with examples (question-answer pairs)



- Number of examples:
 - Zero -> zero-shot prompting
 - One -> one-shot prompting
 - More than one -> few-shot prompting

Zero-shot prompting

- Providing a prompt without examples
- Model generates responses based on its knowledge
- Ideal for quick and uncomplicated tasks

```
prompt = "What is prompt engineering?"  
print(get_response(prompt))
```

Prompt engineering refers to designing and refining prompts or instructions given to a language model like ChatGPT to elicit desired responses or behaviors. It involves formulating specific guidelines or hints to guide the model's output towards a desired outcome.

One-shot prompting

- Provide the model a single example
- Useful for consistent formatting or style

```
prompt = """
Q: Sum the numbers 3, 5, and 6. A: 3+5+6=14
Q: Sum the numbers 2, 4, and 7. A:
"""

print(get_response(prompt))
```

2+4+7=13

One-shot prompting

```
prompt = """  
Q: Sum the numbers 3, 5, and 6. A: The sum of 3, 5, and 6 is 14  
Q: Sum the numbers 2, 4, and 7. A:  
"""  
print(get_response(prompt))
```

The sum of 2, 4, and 7 is 13

Few-shot prompting

- Provide more than one example
- Powerful for contextual tasks

```
prompt = """
Text: Today the weather is fantastic -> Classification: positive
Text: The furniture is small -> Classification: neutral
Text: I don't like your attitude -> Classification: negative

"""
```

Few-shot prompting

- Provide more than one example
- Powerful for contextual tasks

```
prompt = """
Text: Today the weather is fantastic -> Classification: positive
Text: The furniture is small -> Classification: neutral
Text: I don't like your attitude -> Classification: negative
Text: That shot selection was awful -> Classification:
"""

print(get_response(prompt))
```

negative

Few-shot prompting with a chat model

```
response = client.chat.completions.create(  
    model = "gpt-3.5-turbo",  
    messages = [{  
        "role": "user",  
        "content": "Today the weather is fantastic"},  
        {"role": "assistant",  
        "content": "positive"},  
        {"role": "user",  
        "content": "I don't like your attitude"},  
        {"role": "assistant",  
        "content": "negative"},  
        {"role": "user",  
        "content": "That shot selection was awful"}  
    ],  
    temperature = 0  
)  
print(response.choices[0].message.content)
```

negative

Considerations

- Choose number of shots according to **task complexity**
 - Fewer shots -> basic tasks
 - Diverse shots -> complex tasks



Let's practice!

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Multi-step prompting

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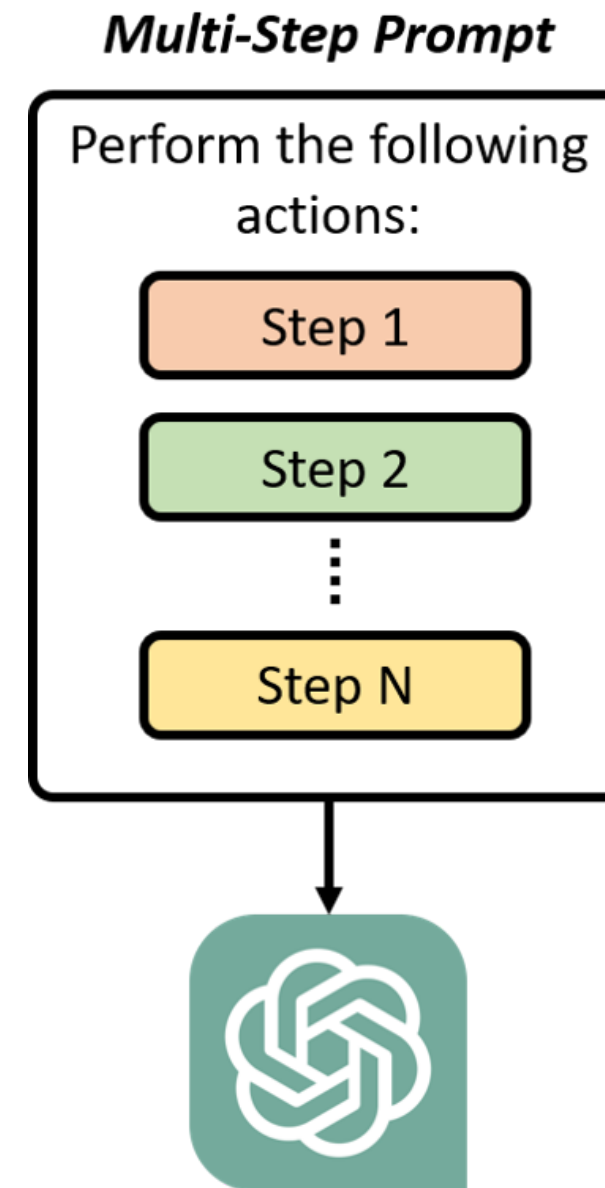


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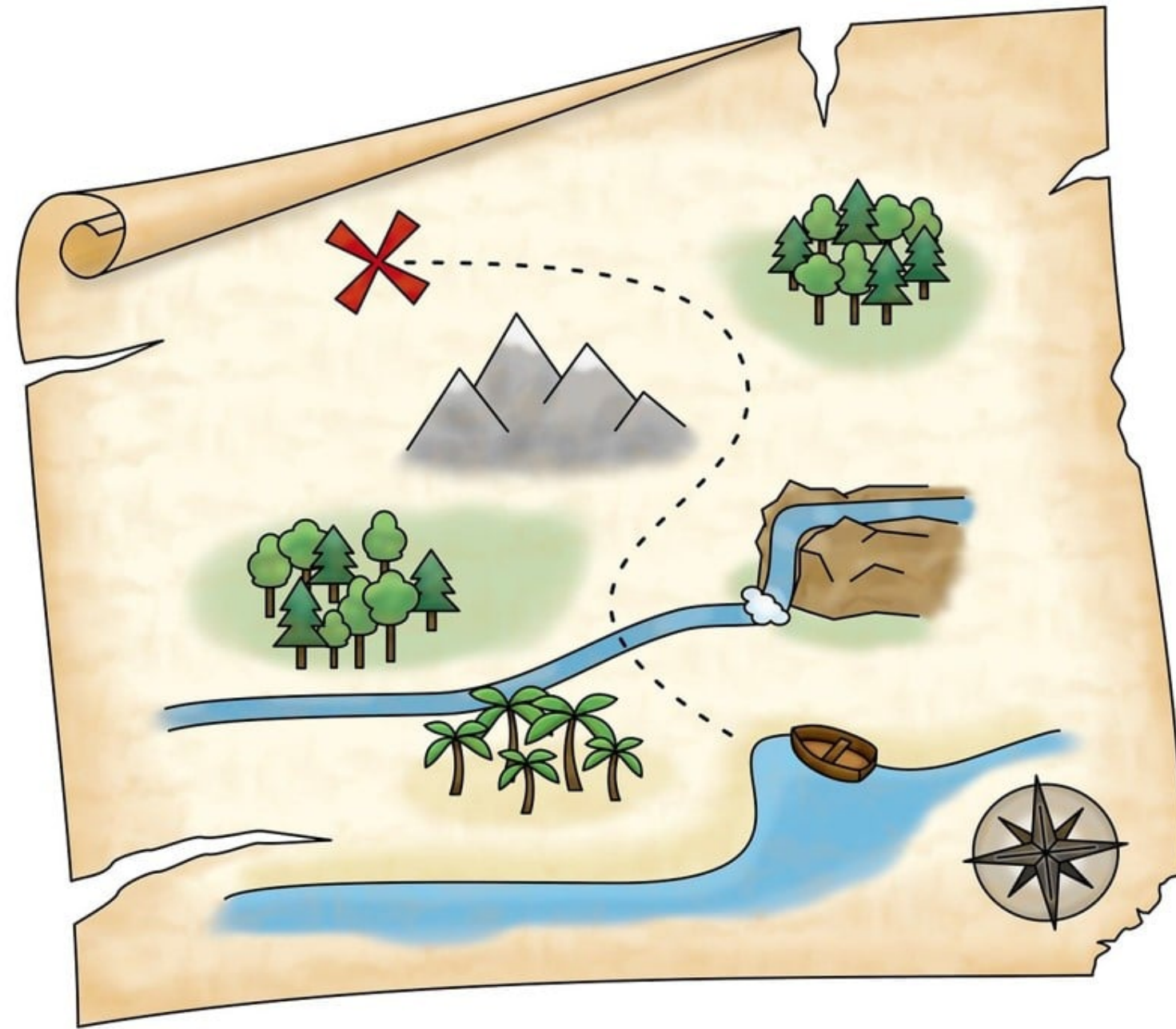
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Multi-step prompting

- Break down an end goal into series of steps
- Model goes through each step to give final output
- Multi-step prompts are used for:
 - Sequential tasks
 - Cognitive tasks



Multi-step prompts as treasure maps



Single-step prompt: writing a blog

```
prompt = "Compose a travel blog"  
print(get_response(prompt))
```

Title: Exploring the Enchanting Landscapes of Iceland

Introduction: Welcome to my travel blog! Today, I am thrilled to share my unforgettable journey through the mesmerizing landscapes of Iceland.

Day 1: Reykjavik - The Charming Capital [...]

Day 2: Golden Circle - Nature's Wonders [...]

Day 3: South Coast - A Journey of Ice and Fire [...]

Day 4: Glacier Lagoon - A Frozen Wonderland [...]

Day 5: Blue Lagoon - A Relaxing Finale [...]

Multi-step prompt: writing a blog post

```
prompt = """Compose a travel blog as follows:  
Step 1: Introduce the destination.  
Step 2: Share personal adventures during the trip.  
Step 3: Summarize the journey.  
"""  
  
print(get_response(prompt))
```

Writing a travel blog post

Title: Exploring the Enchanting Streets of Barcelona

Step 1: Introduce the destination.

Welcome to Barcelona, a vibrant city nestled along the stunning Mediterranean coast of Spain [...]

Step 2: Share personal adventures during the trip.

Exploring the narrow, winding streets of the Gothic Quarter, I stumbled upon hidden gems at every turn. [...]

Step 3: Summarize the journey.

As my journey through Barcelona came to an end, I couldn't help but feel grateful for the incredible experiences and memories I had made [...]

Analyzing solution correctness

- Checking solution correctness requires multiple steps
- Example:
 - Python code for calculation functions



Analyzing solution correctness

Typical solution to check

```
calculator = """
def add(a, b):
    return a + b
def subtract(a, b):
    return a - b
def multiply(a, b):
    return a * b
def divide(a, b):
    return a / b
"""
```

Single-Step Prompt:

```
prompt = f"""Determine if the code delimited
by triple backticks is correct or not.
Answer by yes or no.
```{calculator}```"""

print(get_response(prompt))
```

Yes

# Multi-step prompting to analyze solution correctness

## Multi-Step Prompt:

```
prompt = f"""Determine the correctness of the code delimited by triple backticks
as follows:
Step 1: Check the code correctness in each function.
Step 2: Verify if the divide function handles the case when dividing by 0.
Code: ```{calculator}```"""

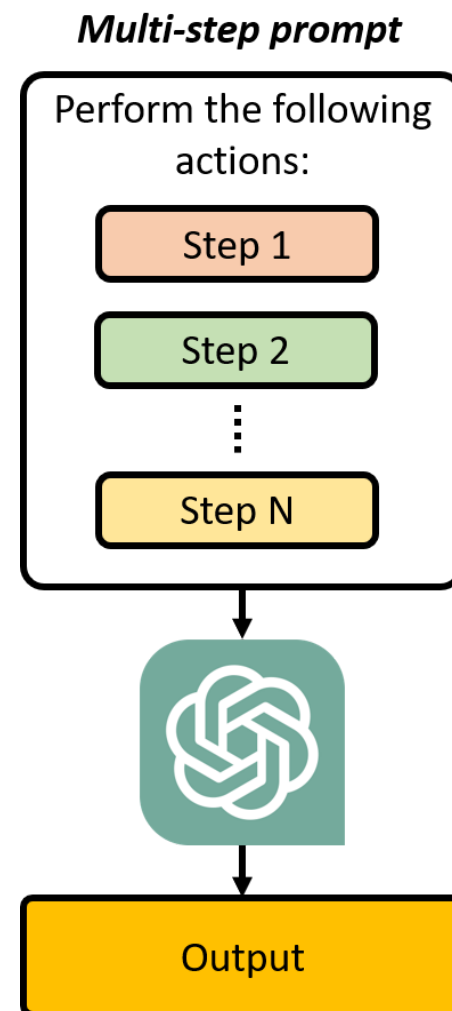
print(get_response(prompt))
```

The code appears to be correct. It defines four functions: add, subtract, multiply, and divide. Each function performs the corresponding mathematical operation and returns the result. However, it does not handle the case when dividing by 0, which can result in a `ZeroDivisionError`.

# Multi-step versus few-shot prompt

## Steps

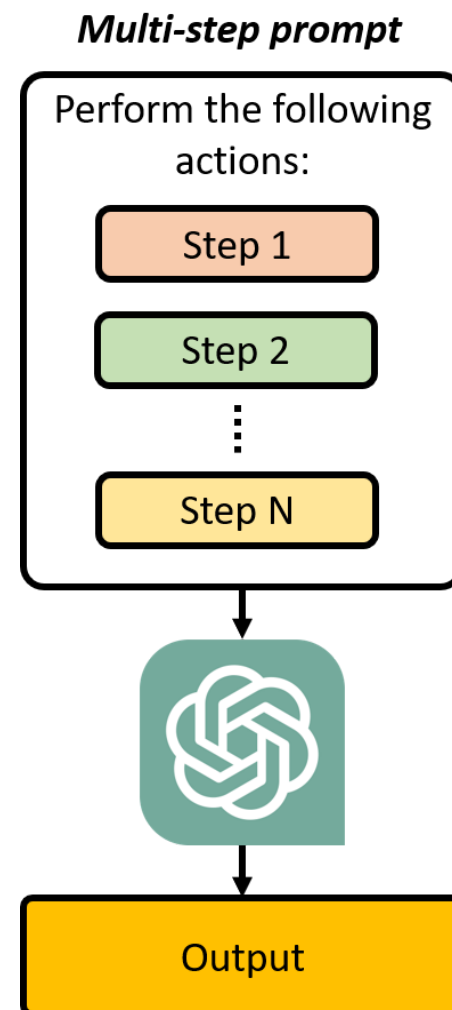
- Explicitly tell model what to do



# Multi-step versus few-shot prompt

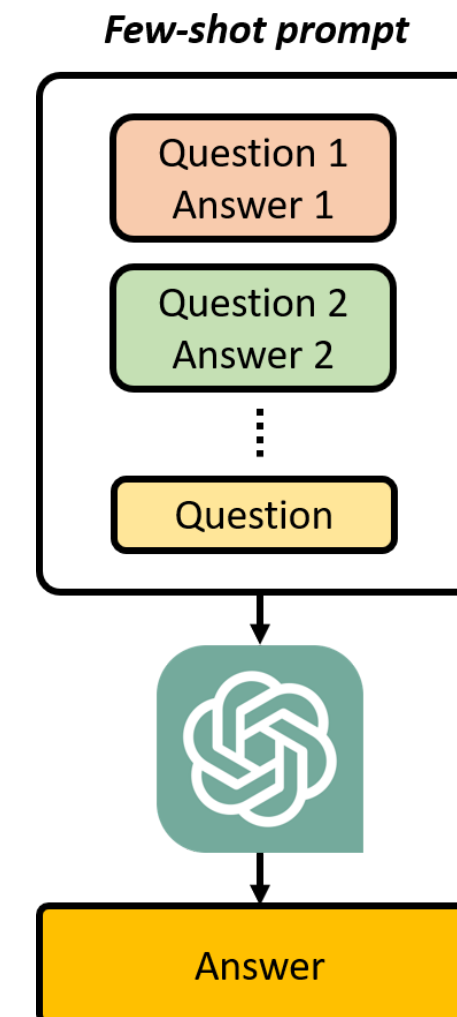
## Steps

- Explicitly tell model what to do



## Shots

- Questions and answers model learns from





# Let's practice!

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# Chain-of-thought and self-consistency prompting

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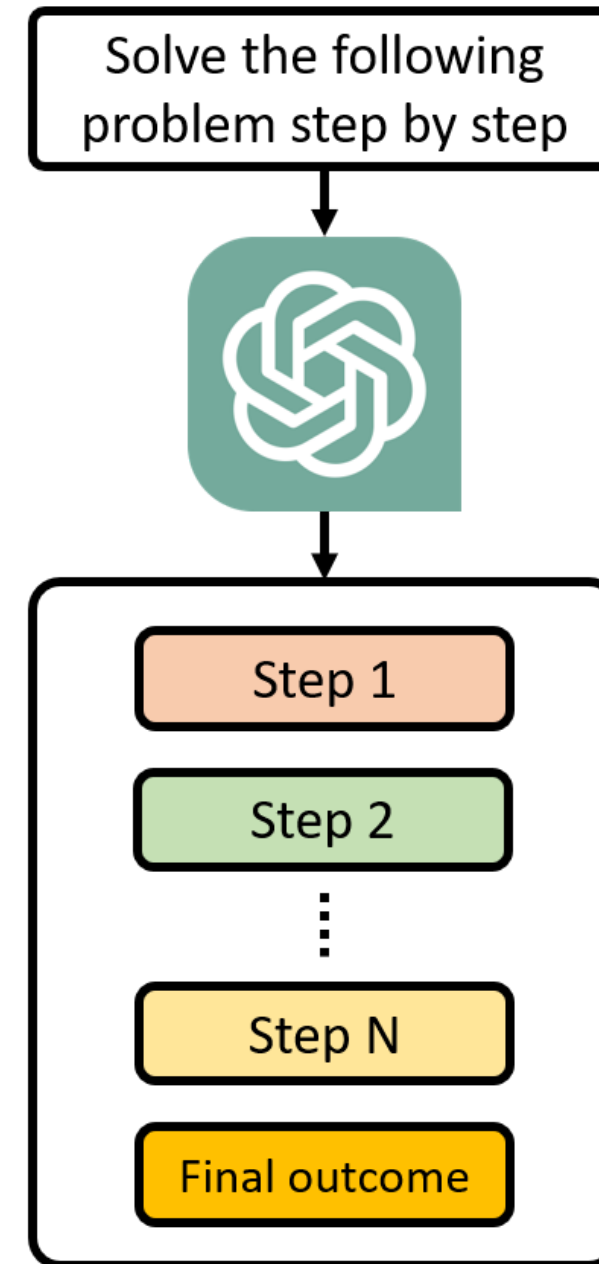


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# Chain-of-thought prompting

- Requires LLMs to provide reasoning steps (thoughts) before giving answer
- Used for complex reasoning tasks
- Help reduce model errors

## *Chain-of-thought prompt*



# Chain-of-thought prompting

## STANDARD PROMPTING TO SOLVE A REASONING TASK

```
prompt = """Q: You start with 15 books in your collection. At the bookstore, you
purchase 8 new books. Then, you lend 3 to your friend and 2 to your cousin. Later,
you visit another bookstore and buy 5 more books. How many books do you have now?
A: The answer is"""

print(get_response(prompt))
```

25 books

# Chain-of-thought prompting

## CHAIN-OF-THOUGHT PROMPTING TO SOLVE A REASONING TASK

```
prompt = """Q: You start with 15 books in your collection. At the bookstore, you
purchase 8 new books. Then, you lend 3 to your friend and 2 to your cousin. Later,
you visit another bookstore and buy 5 more books. How many books do you have now?
A: Let's think step by step"""
print(get_response(prompt))
```

```
Step 1: Start with the number of books in your collection: 15 books
Step 2: Purchase 8 new books at the bookstore: $15 + 8 = 23$ books
Step 3: Lend 3 books to your friend: $23 - 3 = 20$ books
Step 4: Lend 2 books to your cousin: $20 - 2 = 18$ books
Step 5: Visit another bookstore and buy 5 more books: $18 + 5 = 23$ books
Therefore, you have 23 books now.
```

# Chain-of-thought prompting with few-shots

```
example = """
Q: The odd numbers in this group add up to an even number: 9, 10, 13, 4, 2.
A: Adding all the odd numbers (9, 13) gives 22. The answer is True.
"""

question = """
Q: The odd numbers in this group add up to an even number: 15, 13, 82, 7.
A:
"""

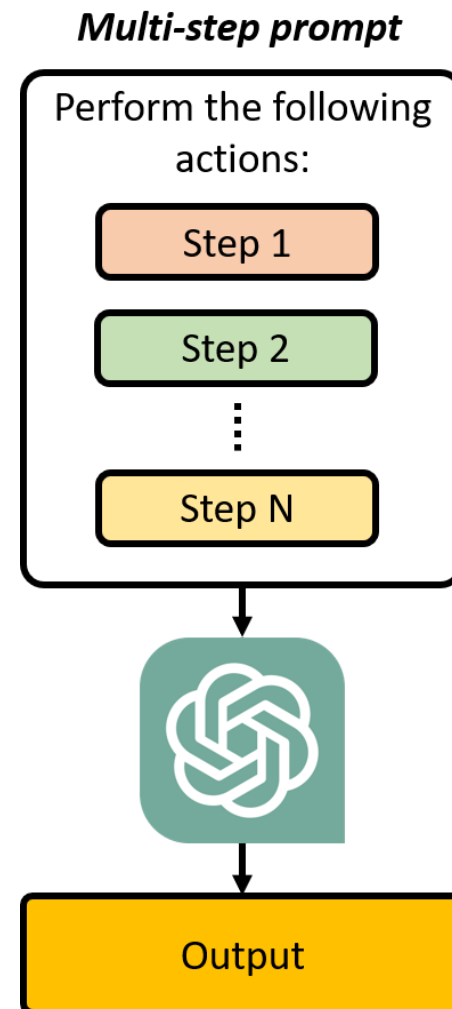
prompt = example + question
print(get_response(prompt))
```

Adding all the odd numbers (15, 13, 7) gives 35. The answer is False.

# Chain-of-thought versus multi-step prompting

## Multi-step prompts

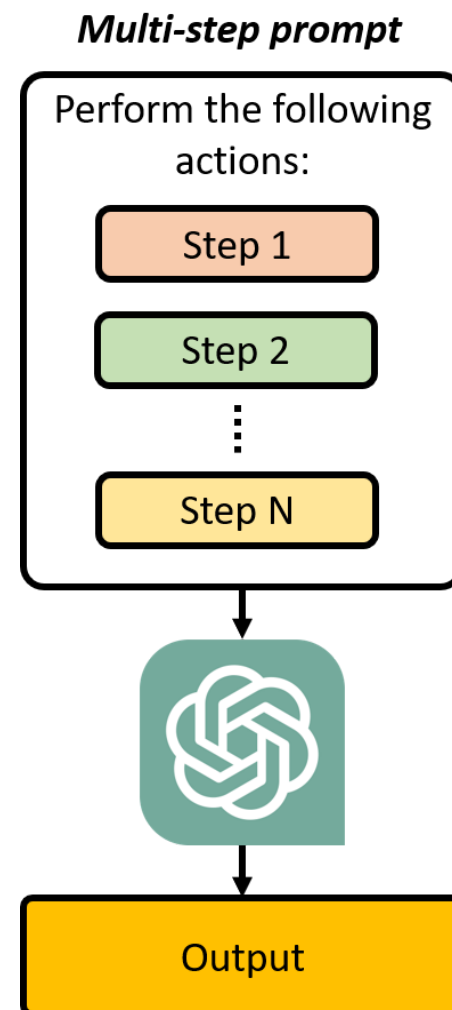
- Incorporate steps inside the prompt



# Chain-of-thought versus multi-step prompting

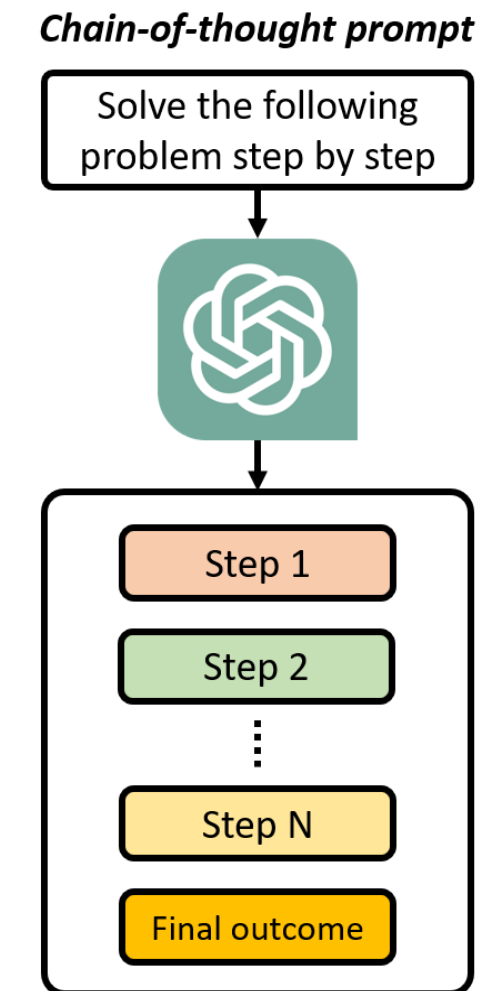
## Multi-step prompts

- Incorporate steps inside the prompt



## Chain-of-thought prompts

- Ask model to generate intermediate steps

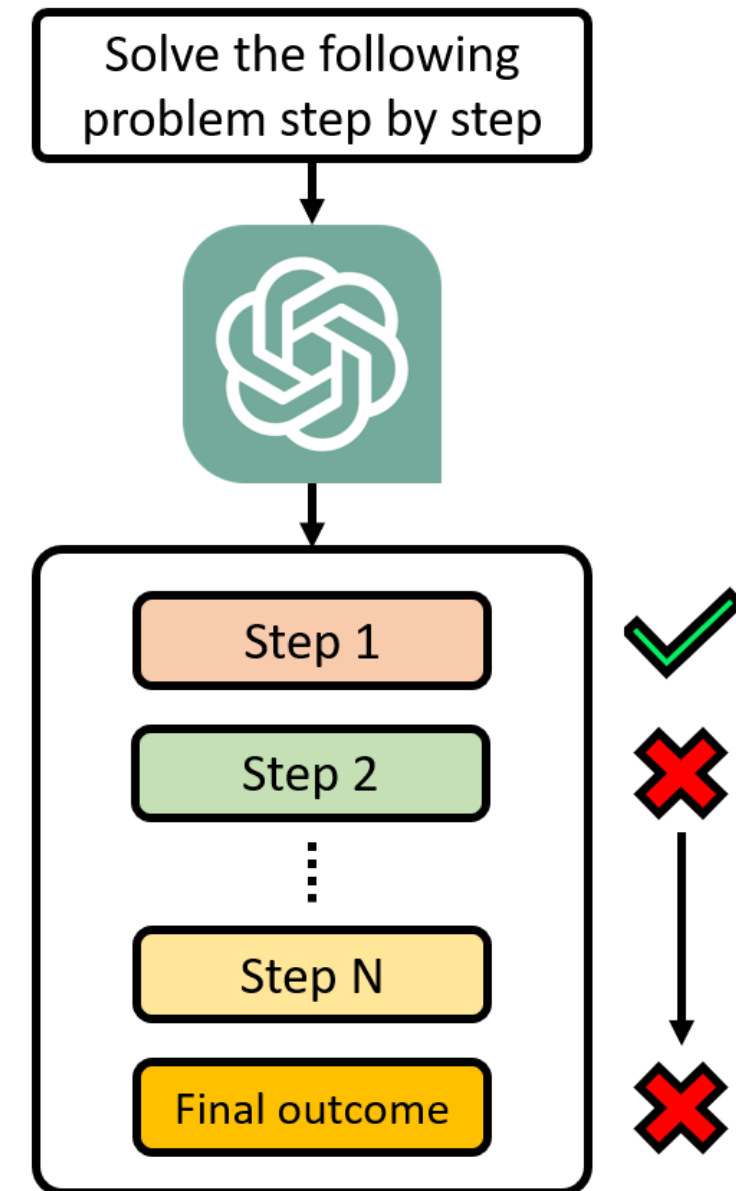




# Chain-of-thought limitation

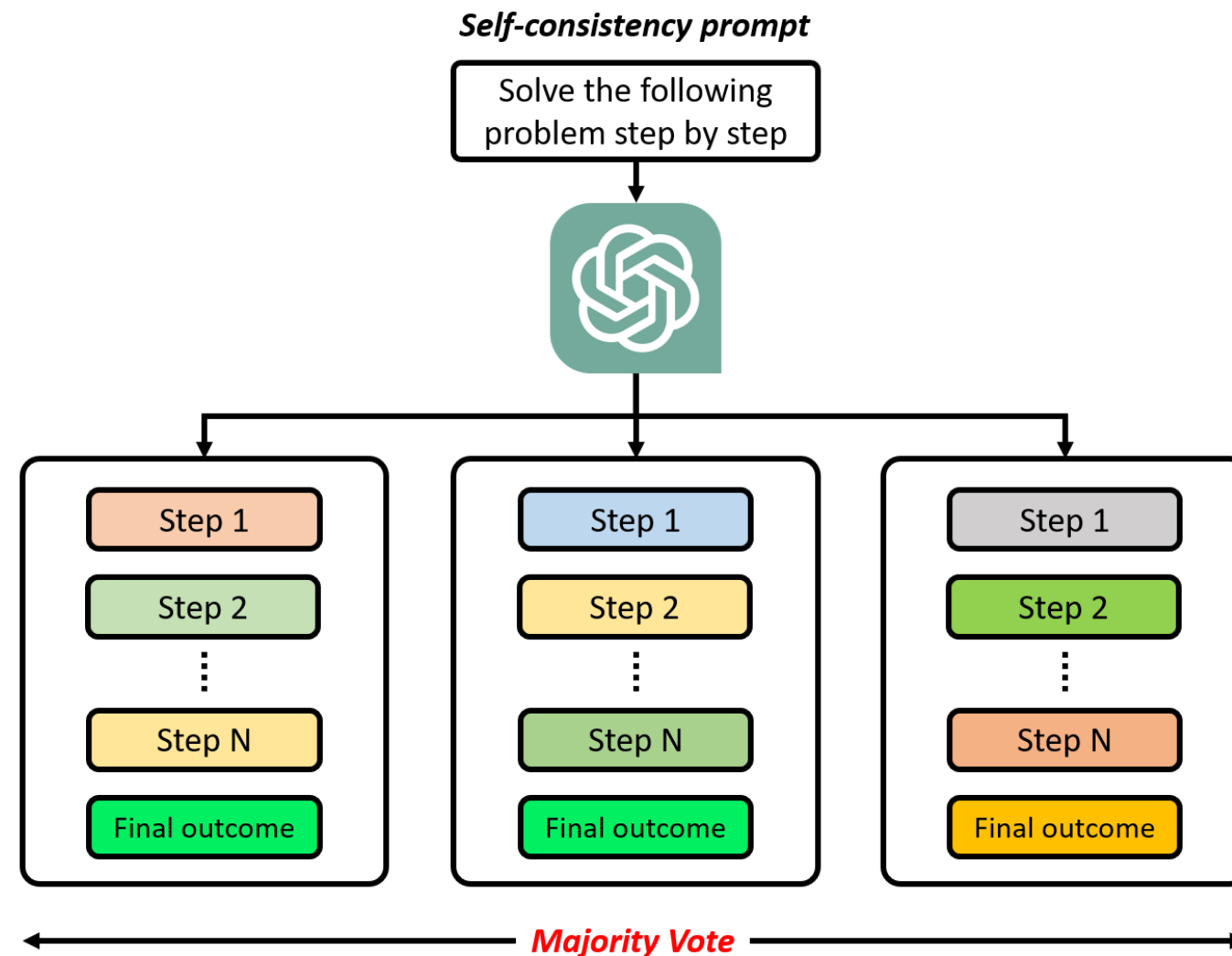
- One unsuccessful thought --> unsuccessful outcome
- **Self-consistency prompts** were introduced

*Chain-of-thought prompt*



# Self-consistency prompting

- Generates multiple chain-of-thoughts by prompting the model several times
- Majority vote to obtain final output



# Self-consistency prompting

Can be done by defining **multiple prompts** or a **prompt generating multiple responses**.

```
self_consistency_instruction = "Imagine three completely independent experts who
reason differently are answering this question. The final answer is obtained by
majority vote. The question is: "

problem_to_solve = "If there are 10 cars in the parking lot and 3 more cars arrive.
Half the original number of cars leave. Then, half of the current number of cars
arrive. How many cars are there in the parking?"

prompt = self_consistency_instruction + problem_to_solve

print(get_response(prompt))
```

# Self-consistency prompt

Expert 1: Let's go step by step [...] Therefore, the total number of cars in the parking lot is  $8 + 4 = 12$ .

Expert 2: First, let's calculate [...] Therefore, the total number of cars in the parking lot is now  $5 + 2 = 7$  cars.

Expert 3: Initially, there are 10 cars [...] Thus, the final answer is  $8 + 4 = 12$  cars in the parking lot.

Based on the majority vote, the final answer is that there are 12 cars in the parking lot.

# Let's practice!

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# Iterative prompt engineering and refinement

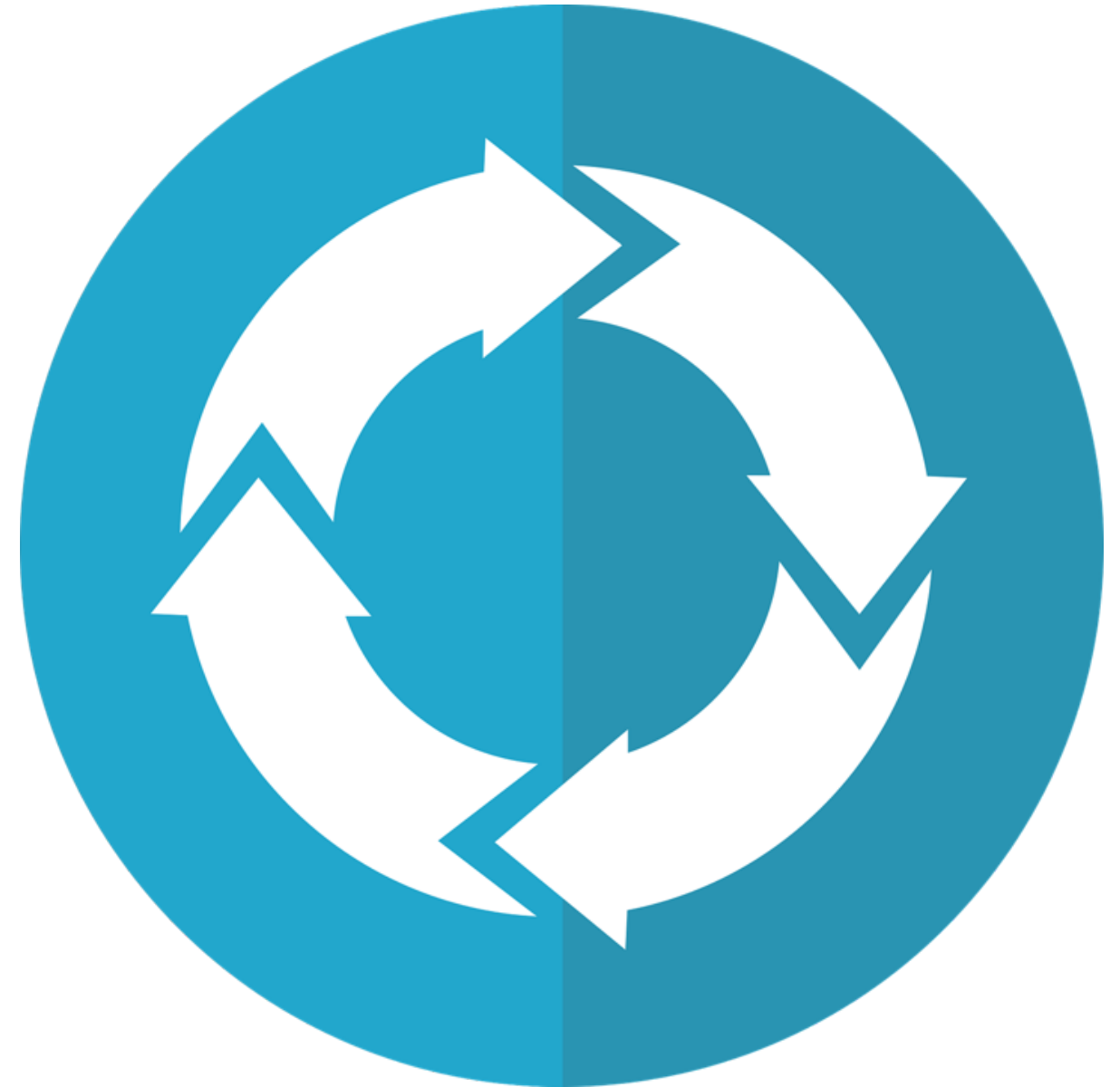
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# Iterative prompt engineering

- No prompt can be perfect at the beginning
- Prompt Engineering is an iterative process where we:
  - Build a prompt
  - Feed it to the model
  - Observe and analyze the output
  - Reiterate to make the prompt better



# Refining prompts

## Initial prompt

```
prompt = "Generate an Excel sheet containing
five student names and their grades"

print(get_response(prompt))
```

I'm sorry, but as a text-based AI, I am unable to directly provide an Excel sheet. However, I can help you generate a sample representation of the data you requested.

## Refined prompt

```
prompt = "Generate a table that I can copy
to Excel, containing five student names and
their grades"

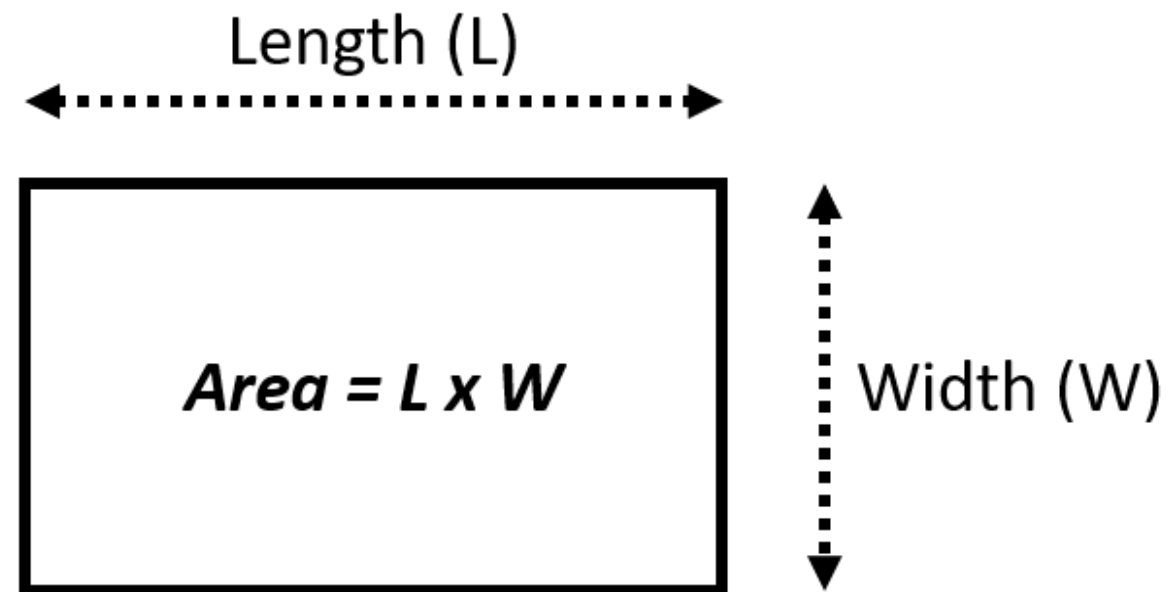
print(get_response(prompt))
```

Student Name	Grade
Student 1	90
Student 2	85
Student 3	95
Student 4	88
Student 5	92



# Example: analyzing a python function

```
code = '''
def calculate_rectangle_area(length, width):
 area = length * width
 return area
'''
```



# Example: initial prompt

```
prompt = f"""
 Analyze the code delimited by triple backticks with one sentence
    ```{code}```.  
    """  
  
print(get_response(prompt))
```

The code calculates the area of a rectangle based on its length and width.

Example: prompt refinement

We modify prompt to get programming language

```
prompt = f"""
    Analyze the code delimited by triple backticks and provide its programming
    language with one sentence
    ```{code}```.
 """

print(get_response(prompt))
```

The provided code is a function written in Python that calculates the area of a rectangle based on its length and width.

# Example: prompt refinement

We modify prompt to get structured output

```
prompt = f"""
 For the function delimited by triple backticks, provide in a structured format
 the following:
 - description: one sentence short description
 - language: the programming language used
 - input: the inputs to the function
 - output: the output returned by the function
    ```{code}```.
    """

print(get_response(prompt))
```

Example: prompt refinement

description: This function calculates the area of a rectangle.

language: Python

input:

- length: The length of the rectangle.
- width: The width of the rectangle.

output:

- area: The calculated area of the rectangle, which is the product of the length and width.

Few-shot prompt refinement

- Weather description classification

Initial prompt

```
prompt = """
Clear skies and a gentle breeze. -> Sunny
Heavy rain and thunderstorms expected. -> Rainy
Fresh snowfall with freezing temperatures. ->
"""

print(get_response(prompt))
```

Snowy

Few-shot prompt refinement

- Weather description classification

Initial prompt

```
prompt = """
Clear skies and a gentle breeze. -> Sunny
Heavy rain and thunderstorms expected. -> Rainy
The wind of change brought a refreshing breeze to the company's operations. ->
"""

print(get_response(prompt))
```

Windy

Few-shot prompt refinement

Refined prompt

```
prompt = """
Clear skies and a gentle breeze. -> Sunny
Heavy rain and thunderstorms expected. -> Rainy
The political climate in the country was stormy -> Unknown
The wind of change brought a refreshing breeze to the company's operations. ->
"""

print(get_response(prompt))
```

Unknown

Prompt refinement for various prompt types

- Few-shot prompts: refine examples
- Multi-step prompts: refine guiding steps
- Chain-of-thought and self-consistency prompts: refine problem description



Let's practice!

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