

Plan-and-Solve Prompting – what is it about?

Source: Conversation with OpenAI GPT-4.o - February 13, 2025

 **You:**

What I intend to do is simple: I want to solve a problem with the helping hand of an AI language model.

Now, in order to 'solve' a problem I have to have a '...' how to do, right?

Well, according to you, what do I have to have?

 **GPT-4.o:**

You have to have a **clear understanding of the problem** first!

Before solving anything, you need:

1. A well-defined **problem statement** – What exactly is the issue?
2. Relevant **information** – What do you already know, and what do you need to find out?
3. A **strategy** or framework – Logical steps or methods to approach the solution.
4. **Tools & resources** – This could be AI, data, experience, or expert advice.
5. **Execution & evaluation** – Implementing the solution and checking if it actually works.

So, before solving a problem, you need **clarity** on what the problem is and a **plan on** how to approach it.

What problem are you trying to solve?

 **You:**

I have to have a clear understanding of the problem first, you say, which includes a well-defined problem statement.

However, I should also have a well-defined problem plan, beyond a well-defined problem statement. What do you think?



GPT-4.0:

That's an interesting take! A well-defined problem plan definitely sounds more action-oriented than just a problem statement.

Here's how I see it:

- A problem statement helps you **understand** the issue. It defines what's wrong, why it matters, and any constraints.
- A problem plan helps you **solve** the issue. It lays out steps, strategies, and resources needed to find a solution.

If you're focused on **solving** rather than just understanding, then yes, a well-defined problem **plan** is more practical. However, the plan still depends on having a clear problem statement first—otherwise, you might plan for the wrong problem!

Would you like help in structuring a solid problem plan for your situation?



You:

So, what I do is to plan and to solve, right?



GPT-4.0:

Exactly! You plan first, then solve.

The process looks like this:

1. Understand the problem → What's wrong? Why does it matter?
2. Create a problem plan → How will you approach solving it? What steps, resources, and strategies do you need?
3. Execute the plan to solve the problem → Take action, test solutions, and refine as needed.

So yes, your job is to **plan** and **solve**—in that order!

Do you have a specific problem in mind that you want to tackle?

 **You:**

[quote] Large language models (LLMs) have recently been shown to deliver impressive performance in various NLP tasks. [...] Despite the success of Zero-shot-CoT, it still suffers from three pitfalls: calculation errors, missing-step errors, and semantic misunderstanding errors. To address the missing-step errors, we propose Plan-and-Solve (PS) Prompting. It consists of two components: first, devising a plan to divide the entire task into smaller subtasks, and then carrying out the subtasks according to the plan. *[/quote]*

It seems that "planning and solving" is a way of approaching AI-language models under scientific scrutiny. Is it not?

 **GPT-4.0:**

Yes, exactly! "Plan-and-Solve" (PS) Prompting is a structured approach to using AI language models effectively, particularly to improve reasoning and problem-solving in tasks like math, logic, and complex NLP challenges.

The **scientific scrutiny** around LLMs, as mentioned in the quote, highlights issues like:

- Calculation errors (mistakes in arithmetic or logic)
- Missing-step errors (skipping necessary reasoning steps)
- Semantic misunderstanding errors (misinterpreting context or intent)

To counter these, the Plan-and-Solve method:

1. Plans first – Breaking down the problem into structured steps.
2. Solves systematically – Executing the subtasks in order.

This aligns with **human problem-solving strategies**—where we first analyze a problem, outline steps, then execute them methodically.

 **You:**

But you know, there are various similar approaches, subsumed under an overarching concept, known as / named 'chain-of-thought' (such as program-of-thought prompting, least-to-most prompting, thread-of-thought prompting, tree-of-thought prompting, program-of-thought prompting, and so on).

Now, what is exactly makes the plan-and-solve prompting method so special?



GPT-4.0:

You're absolutely right! **Plan-and-Solve (PS) Prompting** is just one approach within the broader Chain-of-Thought (CoT) reasoning framework. Various methods, like **Least-to-Most (LtM)**, **Tree-of-Thought (ToT)**, and **Program-of-Thought (PoT) prompting**, all aim to improve AI reasoning by structuring its thought process.

◆ What Makes Plan-and-Solve (PS) Prompting Special?

PS Prompting introduces a **two-stage problem-solving strategy**:

1. **Planning Stage** → The model first **outlines a structured plan**, breaking the task into smaller, logical subtasks.
2. **Solving Stage** → The model **executes** the plan step by step, ensuring each subtask is handled systematically.

◆ How Is This Different from Other CoT Variants?

- Chain-of-Thought (CoT): Breaks problems into a sequence of reasoning steps but doesn't always pre-plan the entire structure.
- Least-to-Most (LtM): Trains the model to solve progressively harder subproblems but doesn't explicitly "plan" first.
- Tree-of-Thought (ToT): Explores multiple reasoning paths in a tree-like structure, but this can be computationally expensive.
- Program-of-Thought (PoT): Uses structured code-like reasoning, but mainly for problems that can be translated into formal logic or programming.
- Plan-and-Solve (PS): Explicitly separates planning from execution, reducing errors like missing steps and logical inconsistencies.

◆ Why Is PS Important?

Plan-and-solve (PS) prompting mimics human problem-solving more effectively than simple chain-of-thought (CoT) prompting. Instead of thinking "on the fly," it **first organizes thoughts** and **then follows through** methodically—leading to fewer mistakes and better reasoning performance.

Plan-and-solve prompting stands out for a few reasons:

1. **Structured Problem Solving:** Plan-and-solve prompting emphasizes breaking down tasks into specific, actionable steps. This structured approach helps guide the model through the problem-solving process systematically, ensuring clarity and coherence in the generated responses.
2. **Sequential Execution:** The method emphasizes a sequential execution of steps, which aligns well with how humans typically approach complex tasks. By following a step-by-step plan, the model can maintain a clear direction and focus on solving one aspect of the problem at a time.
3. **Flexibility and Adaptability:** While maintaining structure, plan-and-solve prompting allows for flexibility and adaptability in addressing different types of tasks or problems. It enables the model to adjust its approach based on the specific requirements of each scenario, making it versatile across various domains.
4. **Comprehensive Understanding:** By breaking down tasks into smaller steps, plan-and-solve prompting encourages the model to thoroughly understand the problem at hand. This deep comprehension enhances the quality of the generated responses, as the model can draw upon a clear understanding of the problem to provide more insightful solutions.

Overall, plan-and-solve prompting combines structure, flexibility, and comprehension, making it a powerful technique for guiding language models through complex tasks or problems.