



Class: FY BSc

Subject : Prompt Engineering 101

Subject Code:

Chapter: Unit 3

Chapter Name: Problem Formulation: Enabling the Potential of Generative AI

Today's Agenda

1. Problem Formulation
2. Importance of Problem Formulation
3. Problem Formulation vs Prompt Engineering
4. Components of Effective Problem Formulation
5. Problem Diagnosis
6. Problem Decomposition
7. Problem Reframing
8. Problem Constraint Design
9. Key Aspects of Problem Constraint Design
10. Conclusion

1 Problem Formulation

- Problem formulation is a critical step in harnessing the potential of generative AI. It involves clearly defining the problem statement, objectives, and constraints before applying AI algorithms to generate solutions.

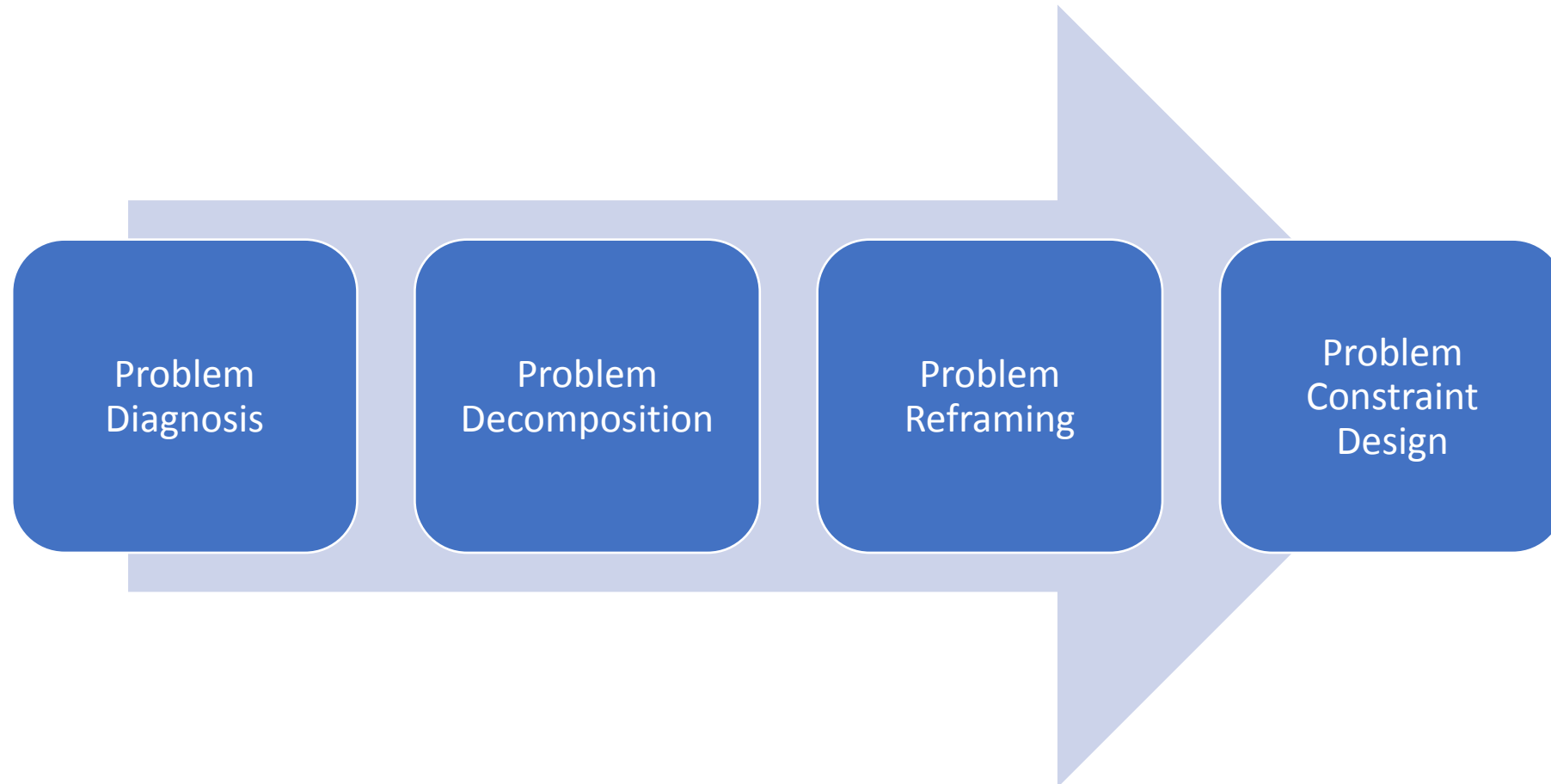
2 Importance of Problem Formulation

- **Enables Focus:** By clearly defining the problem, problem formulation helps narrow down the scope and focus on specific areas that require attention.
- **Enhances Efficiency:** A well-formulated problem allows AI algorithms to generate more accurate and relevant solutions, leading to improved efficiency.
- **Facilitates Innovation:** Problem formulation encourages creative thinking and innovative approaches to problem-solving, enabling the development of novel solutions.
- **Guides Decision-Making:** A well-defined problem statement provides a clear framework for decision-making, ensuring that the generated solutions align with desired outcomes.
- **Reduces Bias:** By explicitly stating the problem and its constraints, problem formulation helps mitigate bias in AI algorithms and promotes fairness and inclusivity.

3 Problem Formulation vs Prompt Engineering

Problem Formulation	Prompt Engineering
Focuses on defining the problem that the generative AI model will solve.	Focuses on designing the prompt or instructions given to the generative AI model.
Involves identifying the objectives, constraints, and desired outcomes of the problem.	Involves crafting the language, context, and format of the prompt to elicit the desired response.
Requires a deep understanding of the problem domain and the target audience.	Requires knowledge of language patterns, biases, and model capabilities.
Involves formulating the problem in a way that is suitable for generative AI.	Involves designing the prompt to guide the generative AI model towards the desired output.

4 Components of Effective Problem Formulation



5 Problem Diagnosis

Identifying the Core Problem

- The first step in problem diagnosis is to identify the core problem that needs to be addressed.
- This involves analyzing the current situation, understanding the pain points, and identifying the root cause of the problem.
- For generative AI, the core problem could be a lack of creativity in content generation or the time-consuming nature of manual content creation.

Defining the Main Objective

- Once the core problem is identified, the next step is to define the main objective for AI to solve.
- This objective should be specific, measurable, achievable, relevant, and time-bound (SMART).
- For generative AI, the main objective could be to develop a system that can generate high-quality, engaging content in a fraction of the time it takes for manual content creation.

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Problem Decomposition

- Problem decomposition is a crucial process in problem-solving that involves breaking down complex problems into smaller, more manageable sub-problems.
- By breaking down a problem into smaller parts, it becomes easier to understand, analyze, and solve.
- This process allows for a more systematic and structured approach to problem-solving, enabling the potential of generative AI.

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Problem Reframing

- Problem reframing is a process that involves changing the perspective and exploring alternative interpretations of a problem.
- By reframing a problem, we can uncover new insights and potential solutions that may have been overlooked.

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Guide to Problem Reframing

1. Define the problem: Start by clearly defining the problem statement. What is the specific issue or challenge that needs to be addressed?
2. Gather information: Collect relevant data, insights, and perspectives related to the problem. This can include conducting research, talking to stakeholders, and analyzing existing solutions.
3. Challenge assumptions: Question the assumptions and beliefs that underlie the problem statement. Are there any implicit biases or preconceived notions that may be limiting our understanding?
4. Change the perspective: Look at the problem from different angles and explore alternative interpretations. This can involve reframing the problem as a question, exploring different contexts, or considering the problem from the perspective of different stakeholders.
5. Generate new ideas: Use the new perspectives and insights gained from reframing the problem to generate innovative ideas and potential solutions. Encourage creativity and open-mindedness during this stage.
6. Evaluate and select: Evaluate the generated ideas based on feasibility, impact, and alignment with the desired outcomes. Select the most promising ideas to further develop and implement.

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Problem Constraint Design

- Problem constraint design is a crucial step in problem formulation as it helps delineate the boundaries of a problem and define input, process, and output restrictions.
- By carefully designing problem constraints, we can ensure that the problem is well-defined and that the generative AI system can effectively operate within those constraints.

10 Key Aspects of Problem Constraint Design

Aspect	Description
Input Constraints	Define the allowable range or format of input data. This could include specifying required data types, data formats, or any limitations on the input data.
Process Constraints	Specify the limitations or restrictions on the generative AI system's internal processes. This could include computational constraints, memory limitations, or any other technical considerations.
Output Constraints	Define the desired output format or limitations on the generated output. This could include specifying required output types, output formats, or any constraints on the output data.
Boundary Conditions	Identify any specific conditions or scenarios that need to be considered within the problem space. This could include edge cases, exceptions, or any other special circumstances.
Trade-offs	Consider any trade-offs or compromises that need to be made in the problem constraint design. This could involve balancing between different constraints or optimizing for specific objectives.

11 Conclusion

Importance of Problem Formulation

- Problem formulation is a critical step in the development and deployment of generative AI.
- It helps align AI outcomes with the desired task objectives.
- Proper problem formulation ensures that AI systems generate outputs that are meaningful, useful, and aligned with human values.

Role of Problem Formulation

- Problem formulation defines the scope and constraints of the AI task.
- It helps identify the relevant data, models, and evaluation metrics.
- Effective problem formulation enables the potential of generative AI to be fully realized.

Key Takeaways

- Problem formulation is essential for ensuring the responsible and ethical use of AI.
- It enables AI systems to generate outputs that meet the desired objectives.
- Proper problem formulation is crucial for addressing biases and ensuring fairness in AI systems.