

Introduction to Problem Solving

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Key concepts, steps, and strategies for tackling problems effectively

1. What Is Problem Solving?

Aspect	Description
Definition	A systematic process of identifying a difficulty, analyzing its causes, and implementing a solution.
Goal	Transform an undesirable situation into a desired state.
Scope	Applies to everyday life, academic work, business, engineering, programming, etc.
Nature	Often iterative, non-linear, and may require creativity as well as logical reasoning.

2. The Problem-Solving Cycle

1. Identify the Problem

- Recognize that a gap exists between the current and desired state.
- Clarify the *what*, *where*, *when*, and *why*.

2. Define the Problem

- State it in clear, specific terms.
- Set boundaries (scope, constraints, resources).
- Formulate a *problem statement* (e.g., "How can we reduce checkout time by 30% in the next 3 months?").

3. Analyze the Problem

- Gather data and evidence.
- Break the problem into sub-problems (decomposition).
- Identify root causes (e.g., using **5 Whys**, **Fishbone diagram**).

4. Generate Options (Ideate)

- Brainstorm multiple possible solutions without judging them.

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- Encourage divergent thinking (quantity > quality).
- Use techniques: mind maps, SCAMPER, analogical reasoning.

5. Evaluate & Select

- Apply criteria: feasibility, cost, time, impact, risk.
- Use decision tools: **Decision matrix**, **Cost-Benefit analysis**, **Pareto analysis**.
- Choose the most promising solution (or a combination).

6. Plan Implementation

- Outline steps, assign responsibilities, set milestones.
- Identify required resources and potential obstacles.
- Develop a **Gantt chart** or **Kanban board** for tracking.

7. Execute

- Follow the plan, monitor progress, and adjust as needed.
- Communicate regularly with stakeholders.

8. Review & Reflect

- Assess outcomes against objectives.
- Document lessons learned.
- Determine if the problem is fully solved or if further iteration is needed.

Tip: The cycle is not strictly linear; you may loop back to earlier stages when new information emerges.

3. Core Problem-Solving Strategies

Strategy	When to Use	Key Steps
Trial-and-Error	Simple problems, low cost of failure	Test possible solutions, learn from each outcome.
Algorithmic	Well-defined problems with clear rules (e.g., sorting)	Follow a step-by-step procedure that guarantees a solution.
Heuristic	Complex or time-constrained problems	Apply “rules of thumb” (e.g., divide and conquer , working backwards).

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Strategy	When to Use	Key Steps
Analogy	Need fresh perspective	Map the problem onto a similar situation that has a known solution.
Optimization	Goal is to maximize/minimize a metric	Formulate objective function, use linear programming, greedy methods, or metaheuristics (GA, Simulated Annealing).
Root Cause Analysis	Persistent or recurring issues	Use 5 Whys , Ishikawa (fishbone) diagrams to trace underlying causes.
Design Thinking	Human-centered, creative challenges	Empathize ? Define