# Online Problem Solving

Soyoung Chon

1. **Which problems did you work through?**

   I worked through four problems: *Tower of Hanoi, Entrapment, Trio Match, and Wolf, Sheep, & Cabbage.*

2. **Which problem was the easiest to solve?**

   *Wolf, Sheep, & Cabbage* was the easiest.

3. **Why was it easy to solve?**

   I found this question easy to solve thanks to my prior experience with similar river-crossing puzzles, such as the one involving *a fox, a chicken, and a bag of beans*. This ease of solving is linked to metacognition, which encompasses thinking about one's thinking processes and drawing upon past knowledge and experiences to tackle new problems. In this case, my familiarity with river-crossing puzzles allowed me to recognize similarities between the current problem and past ones, enabling me to apply a known strategy and find the solution relatively easily.

4. **What type of problem was it (see Kirkley, 2003 article pg. 8)? Explain.**

   The Wolf, Cabbage, and Sheep problem is an example of a well-structured problem. Its solution strategy is highly predictable, involving a consistent step-by-step procedure that ensures the safe transportation of the wolf, cabbage, and sheep across the river without causing harm. The primary constraints involve not leaving the wolf alone with the sheep or the sheep alone with the cabbage. All the necessary information to solve the problem is explicitly and clearly provided in the initial problem statement. While it requires some declarative knowledge, the depth of knowledge needed is minimal. Problem-solving skills in this context are confined to similar river-crossing puzzles, limiting skill transfer to unrelated problems. These distinctive traits collectively categorize the Wolf, Cabbage, and Sheep problem as a well-structured problem.

5. **What strategy did you use to solve the problem?**

I used a strategy based on my previous knowledge and experience with similar river-crossing puzzles. This strategy revolves around comprehending the primary constraints, which involve preventing scenarios where the wolf is left alone with the sheep or the sheep alone with the cabbage.

Here's the strategy I used:

1) First, take the sheep across the river, leaving it on the other side.
2) Go back alone to the starting side, leaving the sheep safely on the other side.
3) Bring the wolf across, but take the sheep back with you to the starting side.
4) Leave the sheep on the starting side and take the cabbage across.
5) Put the cabbage with the wolf on the other side.
6) Finally, return to the starting side alone and bring the sheep across.

This way, the wolf is never left alone with the sheep, and the sheep is never left alone with the cabbage. You can transport all three items safely!

**6. How did you develop this strategy?**

I developed this strategy through my prior exposure to river-crossing puzzles, particularly those involving multiple objects with different constraints (such as a fox, a chicken and a bag of beans). Over time, I observed common patterns and principles in solving such puzzles, which helped me form a general strategy for ensuring safe crossings. The strategy evolved as I encountered different variations of these puzzles and refined my problem-solving approach based on trial and error.

**7. What declarative knowledge was needed to solve this problem?**

I applied declarative knowledge in comprehending the problem's constraints and the possible outcomes of specific actions. Declarative knowledge essential for solving the Wolf, Cabbage, and Sheep problem includes:

- Recognizing the potential risks involved in leaving the wolf alone with the sheep or the sheep alone with the cabbage, understanding that such situations would result in harm.
- Understanding the rule that only one item (wolf, sheep, or cabbage) can be transported in the boat with the person at any given time.
- Identifying the goal of the puzzle, which dictate that all items must be moved from one riverbank to the other without harm.

8. **What procedural knowledge was needed to solve this problem?**

My procedural decisions in solving the Wolf, Cabbage, and Sheep problem were influenced by my declarative knowledge, understanding the rules and constraints clearly. To solve it, I primarily relied on procedural knowledge, involving a sequence of steps to transport the items safely. This procedural knowledge included understanding the problem's rules, safe transportation methods, and decision-making about the order and combinations for moving the items. My previous experience in similar river-crossing puzzles contributed to these procedural skills.

9. **Which problem was the most challenging for you to solve?**

The *Entrapment* Game

10. **Why was it difficult to solve?**

*Entrapment* presented the most challenge because it introduced new mechanics and patterns. My prior experience with games like "Tetris" and river-crossing puzzles helped me adapt quickly to familiar challenges such as *Trio Match* and *Wolf, Sheep, & Cabbage*. However, *Entrapment* required me to build entirely new cognitive strategies and spatial awareness. I excel at recognizing patterns and strategies from similar games, but adapting to *Entrapment*'s unique requirements took time. Developing mental models, such as creating triangles to trap red dots, was crucial. I eventually solved the problem by investing a significant amount of time in developing a strategy and refining my method through persistent trial and error.

11. **What type of problem was it (see Kirkley, 2003 article pg. 8)? Explain.**

*Entrapment* is an example of a moderately-structured problem. The Entrapment game requires players to develop varying strategies and adaptations to fit specific contexts, which involve rearranging dots to make red dots midpoints between gray dots. Within the game, there are often multiple acceptable solution strategies for different puzzles, requiring creative problem-solving skills and evolving mental modeling within each puzzle's unique context. Players must create strategies that fit the specific puzzle, enhancing their problem-solving abilities, including the capacity to apply mental models and adapt to various scenarios. These characteristics collectively categorize *Entrapment* as

a moderately-structured problem with a strong potential for skill transfer across different puzzle contexts.

**12. What strategy did you use to solve the problem?**

My strategy for the Entrapment game centered on a few key elements. I began by understanding the game's objective: ensuring that every red dot served as the midpoint of a line segment connecting two gray dots on the playing field. This involved careful observation of provided examples and initial dot placements, helping me spot recurring patterns and efficient trapping strategies. Following the game page instructions and hints, I prioritized creating triangles with gray dots. This approach demanded both strategic thinking and mental modeling, as I optimized my declarative knowledge for solving these puzzles. I engaged in trial-and-error to refine my strategy by experimenting with various gray dot placements.

**13. How did you develop this strategy?**

The development of my strategy for the Entrapment game involved several essential steps. Firstly, I focused on gaining a clear understanding of the game's objective, ensuring I knew precisely what was required to succeed. Next, I refined my skills by carefully observing patterns in the game's mechanics, especially recognizing the significance of creating triangles with gray dots, which emerged as a recurring key strategy. To enhance my strategy, I engaged in trial-and-error experimentation, repeatedly refining my approach by strategically placing gray dots and evaluating their impact on the game. I also leveraged the hints provided and practiced with simpler puzzles to further develop my mental modeling skills, which were crucial for solving the more complex challenges. A key element of my strategy was persistence; I continuously exploring different approaches until I achieved success in the Entrapment game.

**14. What declarative knowledge was needed to solve this problem?**

Declarative knowledge played a crucial role in solving the Entrapment game. Firstly, understanding the game's objective was pivotal. This involved comprehending the concept of positioning gray circles in such a way that the red circles served as midpoints between them. Recognizing patterns in the placement of dots on the game board was essential for identifying strategic opportunities. Acquiring knowledge of

strategies from the hint section, particularly those related to creating triangles with gray dots, was especially valuable, as it consistently emerged as a central key to solving the game. Overall, comprehending the provided instructions and hints, which emphasized the importance of using gray dots to form triangles, contributed to my declarative knowledge and successfully guided my problem-solving approach.

**15. What procedural knowledge was needed to solve this problem?**

Procedural knowledge played a crucial role in mastering the Entrapment game. It involved applying strategies based on rules, like creating triangles with gray dots. This knowledge was put into action on the game board. Persistent trial-and-error, with strategic placement of gray dots and ongoing evaluation, was essential. I started with simpler scenarios, as instructed, to develop effective mental models for solving complex problems. Insights from previous attempts and game adaptations honed my problem-solving strategy and were critical for success.