Semantic Networks with the Ring

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1 INTRODUCTION

The One Ring presents a complex logical puzzle that demonstrates semantic networks in problem-solving. Four entities must traverse a river: Frodo, Sam, Gollum, and the Ring. The constraints create dependencies that make this challenging to solve through trial and error.

The fundamental challenge lies in the Ring's corrupting influence. Neither Frodo nor Gollum can be trusted alone with the Ring on either side. Additionally, if either character shares the raft with Sam while the Ring is present, they will push Sam overboard. These constraints force careful orchestration where Sam acts as the intermediary.

This problem demonstrates how semantic networks can represent complex state spaces and transitions. By mapping all possible states and connections, we can systematically explore the solution space using generate and test methodology.

2 SEMANTIC NETWORK STRUCTURE AND TWO-STATE EXAMPLE

A semantic network for this problem consists of states connected by transitions. Each state represents a specific configuration of who and what is on each side of the river. I use the notation [L,R,L,R] to represent the positions of Frodo, Sam, Gollum, and Ring respectively, where L indicates the left bank and R indicates the right bank.

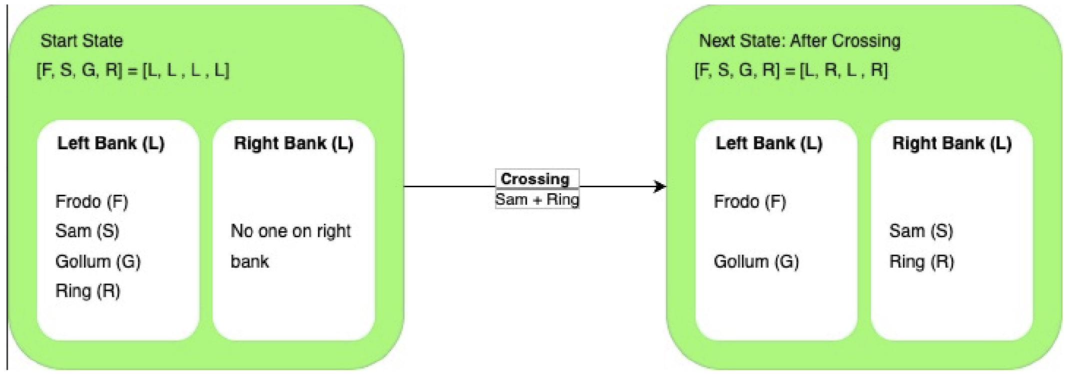

Figure 1— Semantic network transition demonstrating state representation and valid move generation

The figure above shows a basic semantic network with two connected states. The initial state [F,S,G,R] = [L,L,L,L] represents everyone starting on the left bank. The transition "Sam + Ring" leads to state [L,R,L,R], where Sam has crossed with the Ring, leaving Frodo and Gollum safely separated from the Ring on the left side. This demonstrates a key valid move since Sam can safely transport the Ring.

3 Complete Solution Network Using Generate and Test

Using generate and test methodology, I systematically explored the entire problem space. The generator produces all valid moves: Sam can travel alone, Sam can take one other character, or Sam can take the Ring. The generator ensures basic validity but does not check whether resulting states violate the Ring's proximity rules.

The complete semantic network reveals several insights. Green nodes represent valid states that satisfy all constraints, while red nodes indicate invalid states where either Frodo or Gollum is alone with the Ring. Gray nodes mark previously visited states, preventing infinite loops.

Valid states cluster around configurations where the Ring is either with Sam or isolated from both Frodo and Gollum. Invalid states appear when the generator attempts moves that leave vulnerable characters alone with the Ring. The tester evaluates each generated state against the rules and checks if it represents a goal state.

Figure 2— Complete semantic network solution showing all explored states

The successful solution path requires eight transitions: Start → [L,R,L,R] → [L,L,L,R] → [R,R,L,R] → [R,L,L,L] → [R,R,R,L] → [R,L,R,L] → [L,L,R,L] → [L,R,R,R] → [R,R,R,R]. This requires Sam to make multiple round trips, carefully orchestrating movement while maintaining safety.

4 Analysis of Failed States

The semantic network reveals three categories of failed states. States like [R,R,L,L] fail because they leave Gollum alone with the Ring while Sam and Frodo are together on the other side. Another category emerges from states like [L,R,R,L], where Frodo ends up alone with the Ring. These violations occur when the generator attempts moves that break the fundamental constraint about the Ring's corrupting influence.

The network also shows states that fail due to revisiting previous configurations. While not inherently invalid, these represent inefficient paths that the tester eliminates to prevent infinite loops. The systematic mapping of failed states proves as valuable as identifying the successful path, providing insight into the problem's logical structure.

5 Observations and Insights

The semantic network approach reveals several properties of this problem. The solution requires exactly eight transitions, demonstrating complexity despite having only four entities. Many intuitively reasonable moves lead to dead ends, highlighting the non-obvious nature of the correct solution.

The network illustrates Sam's critical role as the only character who can safely handle the Ring. Every successful transition involves Sam moving alone or accompanying another character. This creates a hub-and-spoke pattern where valid paths must repeatedly return to states where Sam controls transportation.

The visualization captures both successful reasoning and failed attempts. Red nodes representing invalid states provide valuable information about the problem's constraints, helping define the boundaries of valid solution space. The generate and test methodology proves effective for this constraint satisfaction problem, ensuring complete coverage while providing clear feedback about path viability.

6 Conclusion

This analysis demonstrates how semantic networks effectively represent and solve complex logical puzzles. The Ring crossing problem showcases the method's ability to handle multiple interacting constraints while maintaining clear visual representation of the solution space.

The semantic network methodology provides a framework for similar constraint satisfaction problems. The clear representation of states, transitions, and validity checks creates a reusable template adaptable to other river-crossing variants or analogous logical challenges. The systematic nature of generate and test ensures complete exploration while efficiently pruning invalid branches.

The solution path through the network reinforces the power of systematic problem-solving approaches. Complex logical relationships become manageable when broken down into discrete states and transitions, each evaluated against clear criteria.