The Quadruple Lock: Mastering the Sudoku Jellyfish Strategy

Sudoku Logic Research

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1 Introduction: The Deep Ocean of Logic

The **Jellyfish** is a legendary pattern in the world of Sudoku. It serves as the "Size 4" iteration of the Fish family, following the X-Wing (Size 2) and the Swordfish (Size 3). While rare in casual puzzles, the Jellyfish is a staple of "Diabolical" or "Extreme" tier solving.

Ideally, a solver should master X-Wings and Swordfish before attempting to spot a Jellyfish. The logic is identical, merely expanded: it relies on the principle that if N rows contain candidate k in only N columns, then those N columns claim candidate k for those rows exclusively.

2 Theoretical Framework

2.1 The General Theorem

Theorem: Let the candidate digit be d. If d appears in 4 Rows (R_1, R_2, R_3, R_4) and, within those rows, is restricted to only 4 Columns (C_1, C_2, C_3, C_4): Then d **must** be the solution in exactly one of the intersections $(R_i \cap C_j)$ for each base row.

Since the 4 Base Rows *consume* the availability of digit d in the 4 Cover Columns, no other row can place digit d in those columns.

Result: Eliminate digit d from all cells in the Cover Columns $(C_1 \dots C_4)$ that are **not** part of the Base Rows $(R_1 \dots R_4)$.

3 Visual Analysis: Horizontal Jellyfish

In the grid below, we are analyzing Candidate **2**.

- **Base Sets (Rows):** 2, 4, 6, 8 (Highlighted Yellow)
- **Cover Sets (Cols):** 2, 4, 6, 8 (Highlighted Blue)

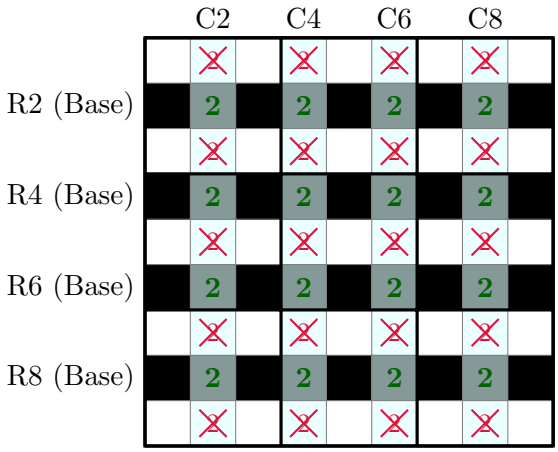

Figure 1: A perfect 4x4 Jellyfish. The locked green candidates eliminate the red candidates.

4 Hierarchy of Fish

The Jellyfish sits near the top of the "Basic Fish" taxonomy.

Pattern	**Size**	**Geometry**	**Frequency**
X-Wing	2	Rectangle	Common
Swordfish	3	Grid (3×3)	Uncommon
Jellyfish	4	Grid (4×4)	Rare
Squirmbag	5	Grid (5×5)	Very Rare

Table 1: Sudoku Fish Taxonomy

5 Conclusion

The Jellyfish is a "pattern of exclusion." It does not tell you where the number *is*; it tells you where the number *cannot be*. By understanding the constraints of rows and columns as interconnected sets, the advanced solver can visualize these large-scale locks and reduce the puzzle to its solution state.