Set-Cover Formalization
Algebraic Analysis: L=15 vs L=17

```
PROBLEM: Minimum constraints to determine all 97 positions

SET-COVER INSTANCE:
• Universe U = {unknown positions}
• Constraint families S = {single-position constraints}
• Each constraint covers exactly 1 element

L=17 CASE:
• |U| = 50 (unknown positions)
• Each s ∈ S covers 1 position
• Minimum cover = 50 constraints
• This is TIGHT (proven empirically)

L=15 CASE:
• |U| = 21 (unknown positions with anchors only)
• Slot reuse enables propagation
• Tail's 23 positions cover all 21 unknowns
• Achieves closure BUT wrong plaintext
```

Property	L=15	L=17
Slot mapping	Reuse (1.08/slot)	1-to-1 (unique)
Anchors only	76/97 derived	24/97 derived
Min constraints	21 additional	50 additional
With tail (23)	Complete (wrong PT)	Incomplete (50 remain)
Produces canonical	NO ✗	YES ✓ (where known)
Algebraic viability	YES	YES
Semantic correctness	NO	YES