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SU-PU STUDIES · LESSON 08

Solution Space, Not Candidate Space

Why ibtree's pencil digits trace a trial solution forward, not every possible candidate in every cell.

Written by the Orbace Sudoku Editorial Team · September 11, 2026 · 8 min read ·

SU-PU STUDIES

EXTREME

IBTREE

BINARY TREE

CROSS-HATCHING

IN THIS STUDY

1. Prepare the Ground
2. Identify the Fork
3. Trace the Assumption
4. Two Kinds of Space
5. Retrospect

01 · PREPARE

Prepare the Ground

Before selecting a chain trigger digit, we want to confirm as many digits as possible using basic cross-hatching and confined group methods. This narrows down the choice of the fork itself — the fewer open cells, the clearer the binary options become.



Imported 45E432

Extreme | 0:03 | Mistakes 0 | Hints 0

7			9					2
		9		8		3		
	8					5	4	
		6	8		1	9		
		4		7			5	
				5			3	
1					8			3
4				6	3	7		
			2				1	

The starting grid, with many givens already in place.

After placing 9 at R3C9 and 1 at R8C4, we can visually identify two confined groups: a 5-7 pair and a 4-9 pair, both in Box 8.



Imported 45E432

Extreme | 1:05 | Mistakes 0 | Hints 0

7			9					2
		9		8		3		
	8					5	4	9
		6	8		1	9		
		4		7			5	
				5			3	
1			⁵ ₇	⁴ ₉	8			3
4			1	6	3	7		
			2	⁴ ₉	⁵ ₇		1	

The confined groups in Box 8 narrow the remaining candidates.

Afterwards, we can confirm 4 at R4C9 — a straightforward cross-hatch placement.



Imported 45E432

Extreme | 1:13 | Mistakes 0 | Hints 0

7			9					2
		9		8		3		
	8					5	4	9
		6	8		1	9		4
		4		7			5	
			4	5	4		3	
1			7 ⁵	4 ⁹	8			3
4			1	6	3	7		
			2	4 ⁹	7 ⁵		1	

Placing the 4 clears one more cell and sharpens the fork ahead.

02 · FORK

Identify the Fork

The 4 at R4C9 is helpful because it presents a binary choice: digit 7 in Box 6 now has exactly two possible homes.



Imported 45E432

Extreme | 1:43 | Mistakes 0 | Hints 0

7			9					2
		9		8		3		
	8					5	4	9
		6	8		1	9	7	4
		4		7			5	
				5			3	7
1			7 ⁵	4 ⁹	8			3
4			1	6	3	7		
			2	4 ⁹	7 ⁵		1	

Box 6 offers a clean fork — two cells, one digit, no ambiguity.

Are there any other binary choices? In Box 5, there are two possible homes for 3. But a quick visual inspection shows that neither 3 in Box 5 would substantially trigger any further forced placements. This selection is less ideal.



Imported 45E432

Extreme | 1:30 | Mistakes 0 | Hints 0

7			9					2
		9		8		3		
	8					5	4	9
		6	8	³	1	9		4
		4	³	7			5	
				5			3	
1			⁷ ⁵	⁴ ⁹	8			3
4			1	6	3	7		
			2	⁴ ⁹	⁷ ⁵		1	

The 3 in Box 5 is also a binary choice, but it doesn't cascade forward.

In contrast, assuming 7 at R6C9 would generate a long reaction. It's a no-brainer to test it through.

03 · TRACE

Trace the Assumption

Assuming 7 at R6C9, we can immediately fill Row 4 with pencil digits.



Imported 45E432

Extreme | 3:19 | Mistakes 0 | Hints 0

7			9					2
		9		8		3	7	
	8			3	2	7	5	4
		6	8		1	9	2	4
		4		7			5	
				5			3	7
1				5	4	8	2	3
4			1	6	3	7		
			2	4	7	5	1	

The assumption cascades into Row 4, filling multiple cells in one step.

Furthermore, we can fill up Box 3 with pencil digits — including a confined group of 6-8 — and many other digits in Box 2 and Box 9.



Imported 45E432

Extreme | 4:27 | Mistakes 0 | Hints 0

7			9	¹		⁶ ₈	⁶ ₈	2
		9	⁵	8		3	⁷	¹
	8		³	²	⁷	5	4	9
⁵	⁷	6	8	³	1	9	²	4
		4		7			5	
				5			3	⁷
1			⁷	⁴ ₉	8	²		3
4			1	6	3	7		
			2	⁴ ₉	⁵	⁴	1	

The assumption continues to cascade: Box 3, Box 2, Box 9 all take shape.

The method used here is cross-hatching — simple, easy, and straightforward. In no time, we can get the entire grid filled with pencil digits.



Imported 45E432

Extreme | 7:31 | Mistakes 0 | Hints 0

7	5	3	9	1	4	8	6	2
2	4	9	5	8	6	3	7	1
6	8	1	3	2	7	5	4	9
5	7	6	8	3	1	9	2	4
3	2	4	6	7	9	1	5	8
9	1	8	4	5	2	6	3	7
1	6	5	7	4	8	2	9	3
4	9	2	1	6	3	7	8	5
8	3	7	2	9	5	4	1	6

The complete grid, every cell accounted for under the assumption.

While converting pencil digits to confirmed digits, we just need to cross-check each digit — horizontally (Box 1-2-3, 4-5-6, 7-8-9) and vertically (Box 1-4-7, 2-5-8, 3-6-9) — to avoid human error.

04 · SPACES

Two Kinds of Space

One important point to make here: in the **candidate reduction (canred)** method, a player needs to fill in all possible digits and then perform rigorous reduction by identifying what is *not* possible in certain cells. In a sense, canred uses pencil digits in the **candidate space** — every cell holds a list of every digit that could still fit.

In the **ibtree (inferential binary tree)** method, pencil digits serve a different role. They represent a trial solution under an assumption, tracing forward along one branch of the fork. In this sense, ibtree uses pencil digits in the **solution space** — a much smaller set, since each cell holds at most one digit under the current assumption, not a full list of remaining candidates.

The Orbase rule for pencil digits in ibtree: pencil marks trace a trial solution forward, not every possible candidate. A smaller space means a faster cascade and a clearer path to the proof.

Ibtree	Candidate reduction
Pencil digits represent one assumed solution at a time.	Pencil digits list every remaining candidate in every cell.
Solution space: one digit per cell, chosen under the current assumption.	Candidate space: multiple digits per cell, reduced step by step.
Fast forward cascade: a single assumption fills the grid quickly.	Systematic elimination: each technique removes one candidate at a time.
Proof by contradiction if the assumption fails; immediate confirmation if it holds.	Gradual narrowing until only one candidate remains in each cell.

05 · RETROSPECT

Retrospect

Was it lucky to try out 7 at R6C9? Yes — the assumption held, and the grid filled cleanly. Was it guesswork? No. If the assumption had caused a conflict, we would have confirmed 7 at R4C8 by proof of contradiction. Either way, the fork resolves.

This is the discipline of ibtree: pick a binary choice, trace it forward in solution space, and let the grid tell you whether the assumption holds or breaks. The pencil digits you write are not a catalog of possibilities — they're a single trial solution, committed enough to cascade forward, light enough to erase if it fails.



Try this in your next solve

Next time you face a fork, trace the assumption forward in solution space — one trial digit per cell, fast and light. Let the cascade do the work.

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Reconstructed from a real personal Su-Pu replay and checked against the recorded grid. Spotted a step that doesn't hold up? Tell us — every Journal article carries an accountable byline and an open correction channel.

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