



香港電腦奧林匹克競賽
Hong Kong Olympiad in Informatics

Introduction to Logic Puzzles

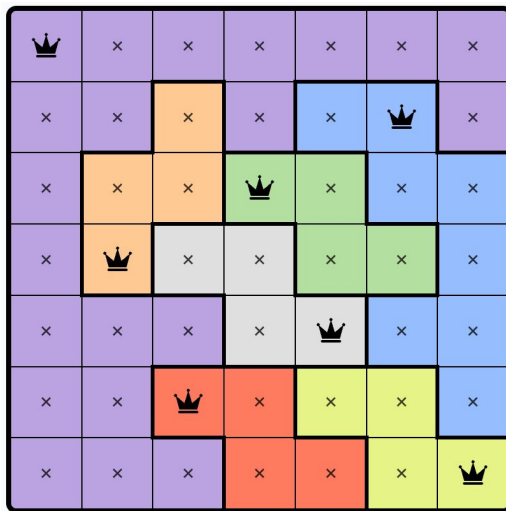
Bosco Wang {happypotato}
2026-06-28

What “logic puzzles” are we talking about?

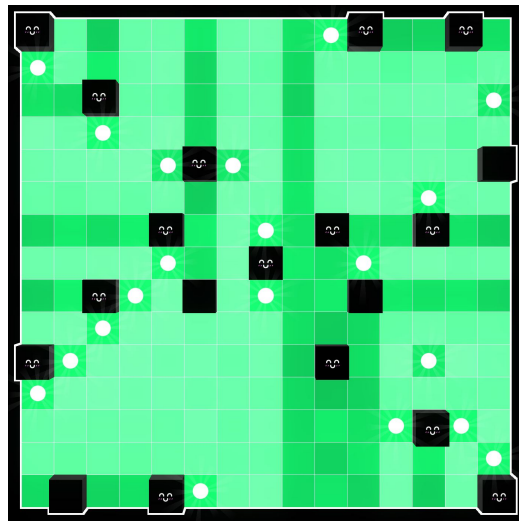
- Today we will mostly cover “grid puzzles” (vs “operation puzzles”)

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

Sudoku

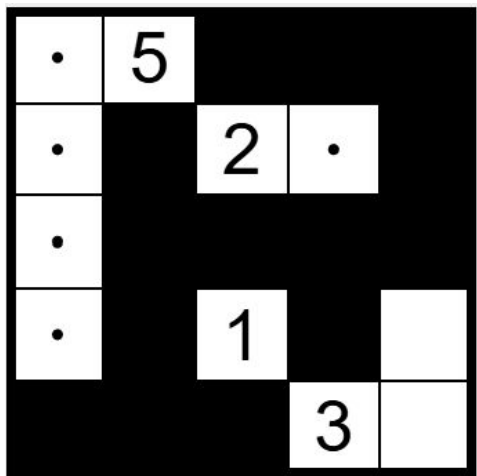


“Queens” (Starbattle)

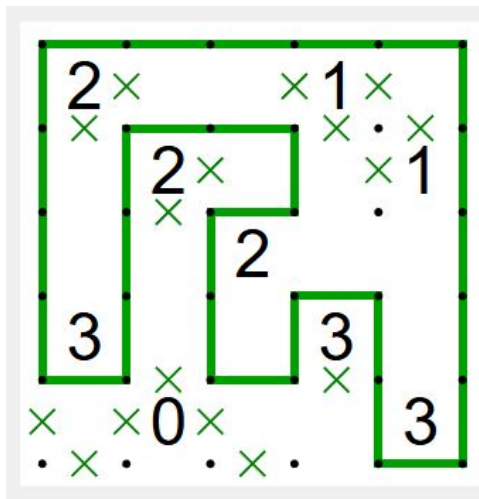


Akari

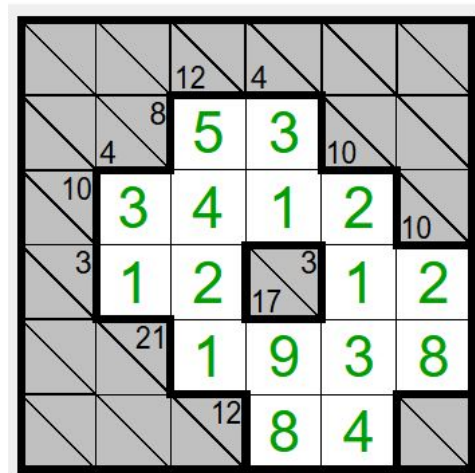
Common Types of Grid Puzzles



Shading Puzzles
(e.g. Nurikabe)



Loop/Connect Puzzles
(e.g. Slitherlink)



Number Puzzles
(e.g. Kakuro)

Logic Grid Puzzles in OI

- [M2344 - Nonogram](#)
- [IOI 2016 Day 2 Task 1 - Paint by Numbers](#) (Nonogram)
- [2nd UCup Finals Problem D - Puzzle: Nurikabe](#)
- [4th UCup Stage 23 Problem G - Puzzle: Artisan of Glimmith](#) (Fillomino)

There are also tasks that are similar to these puzzles:

- [I264 - Shy Students](#)
- [M25DI - Triangular Subnetting](#)
- [M26CD - Dual Duel](#)
- [4th UCup Stage 22 Problem M: Cellular Component Constellation](#)
(Very cool constructive task!)

Popular Logic Grid Puzzle Sites

“Hardcore” puzzle sites:

- Puzzle GP: <https://gp.worldpuzzle.org/content/puzzle-gp>
- PuzzleSquare: <https://puzsq.logicpuzzle.app>
- Toketa: <https://puzzle-toketa.blogspot.com/2099/>
- Puzz.link: <https://puzz.link/>

More chill:

- Daily Akari: <https://dailyakari.com/>
- Logic Pad: <https://logic-pad.com/>

Popular Logic Grid Puzzle Games

Grid-related puzzles:

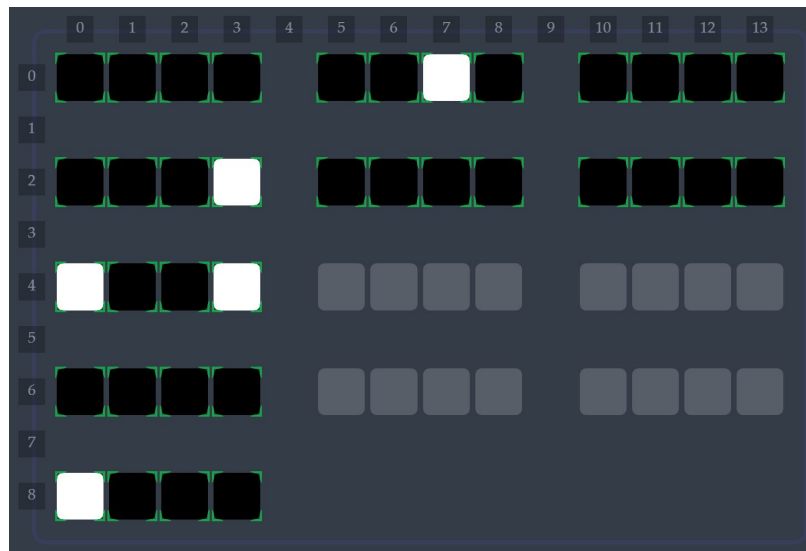
- [The Artisan of Glimmith](#) (“Divide into Areas” puzzles)
- [Island of Insight](#) (“Shading” puzzles)
- [Understand](#) (“Draw a Line” puzzles, guess the rules of the puzzle)
- [The Witness](#) (“Draw a Line” puzzles, lots of “environmental puzzles”)

Operation-related puzzles:

- [Baba Is You](#)
- [A Monster's Expedition](#)
- [Patrick's Parabox](#) (Inspiration for [T254 - Robo's Recursive Realm](#))

Environmental Puzzle Example

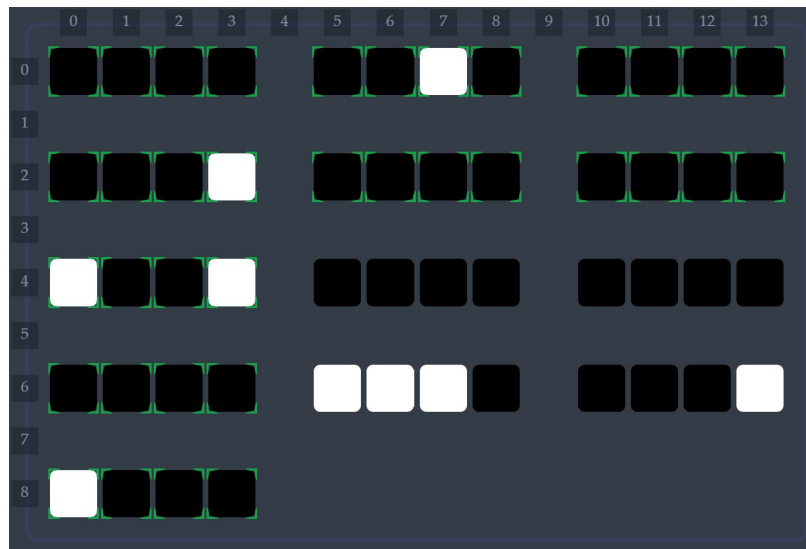
Solve the following environmental puzzle:



Hint: Look around you!

Environmental Puzzle Example

Solve the following environmental puzzle:



Solution: Current seating in SHB 123 (Black = someone is sitting)

Logic Puzzle Strategies

- Do NOT try to guess your way through a puzzle! Only make moves that is 100% correct
 - Almost all puzzles guarantee a unique solution, which implies you can theoretically arrive at the answer only through series of logical deductions
 - If you guess and fail, you won't gain any useful information
- If you are *really* stuck, you can do “casework” on the value of one cell
 - In other words, “dfs for the solution”
 - Sometimes this is necessary, but you should minimise the number of branches; I think you should branch at most twice

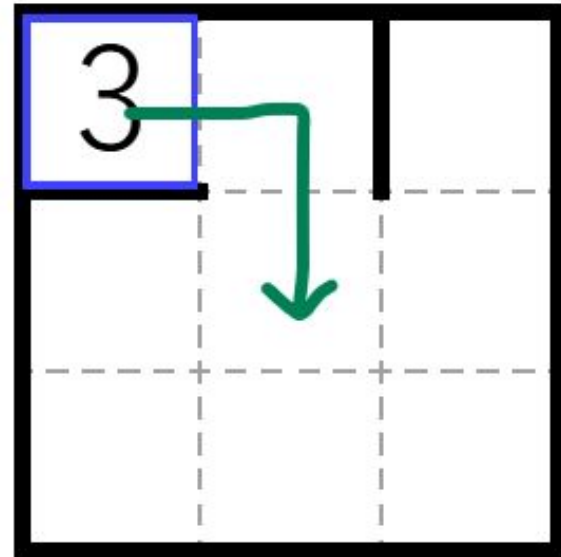
Common Arguments

There are lots of different patterns for arguments (similar to standard algorithms in OI). Here are some of the most common ones:

- Connectivity (e.g. Extensions, Cut)
- Forced Moves
- X-Wing
- Entrance Counting
- Uniqueness

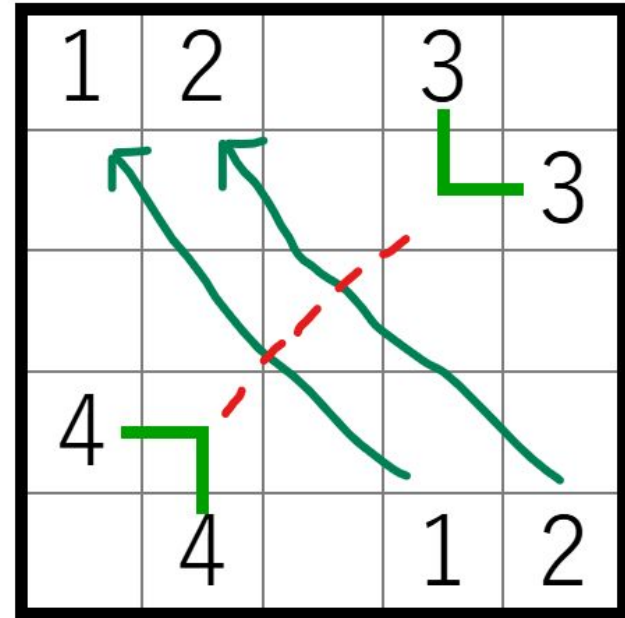
Common Arguments - Connectivity

- “Forced extensions” for Area Numbers
- In this Fillomino puzzle, the only way for this region to have area 3 is to extend this way



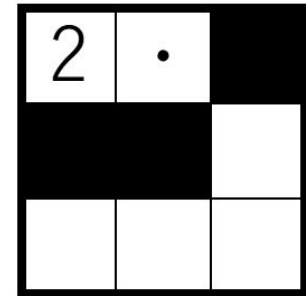
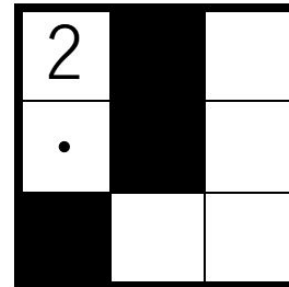
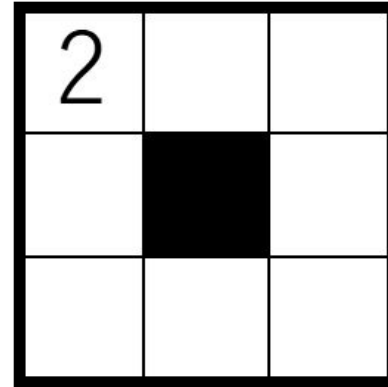
Common Arguments - Connectivity

- “Cut” for Draw a Loop or Connecting puzzles
- “Max-Flow Min-Cut”
- In this Numberlink puzzle, required “flow” is 2, but “min cut” is 1, hence failed



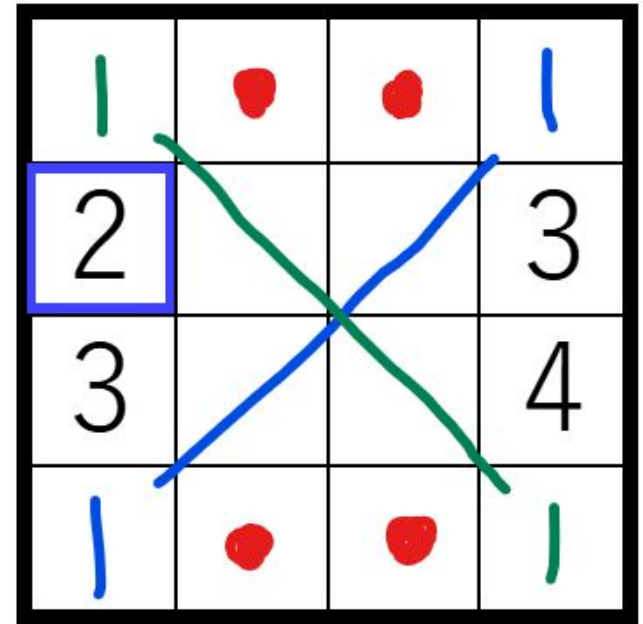
Common Arguments - Forced moves

- Try to find moves in the form “In every possible configuration of (a branching point) xxx, this cell is still xxx”
- Example: “Corner 2” for Shading puzzles
 - If there is a “Corner 2”, the cell diagonal to it must be black
 - As you can see in both configurations the middle cell is black



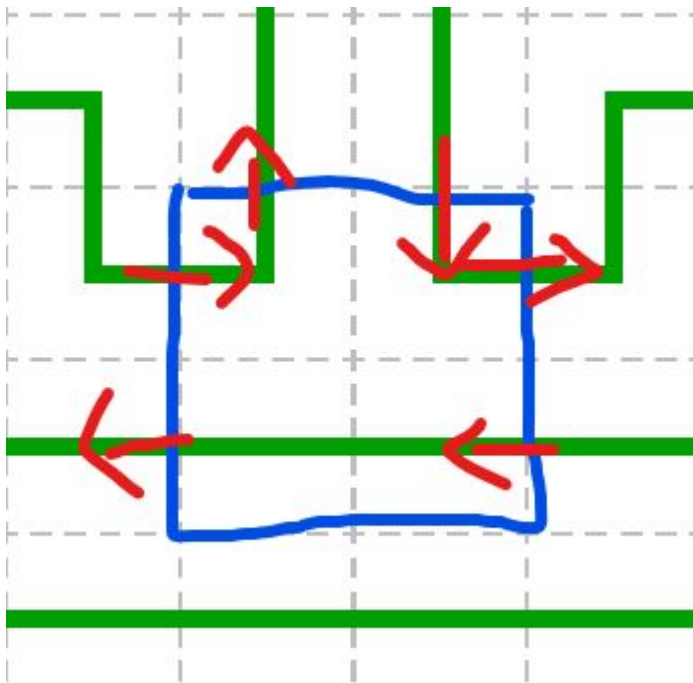
Common Arguments - X-Wing

- Application of Hall's Marriage Theorem
- In this 4x4 Sudoku, by columns, the placement of 1s is either the configuration in blue or in green
 - It forms an X-shape, hence the name
- Then all cells with a red dot cannot be 1



Common Arguments - Parity

- Parity is a very good and useful invariant (in OI too!)
- Example: “Entrance Counting” for Draw a Loop puzzles
 - Every connected region R must have even number of “crossing edges”, in the example it is 6
 - Consider walking along the cycle. You start at R and end at R, so the number of transitions going in/out R must be even

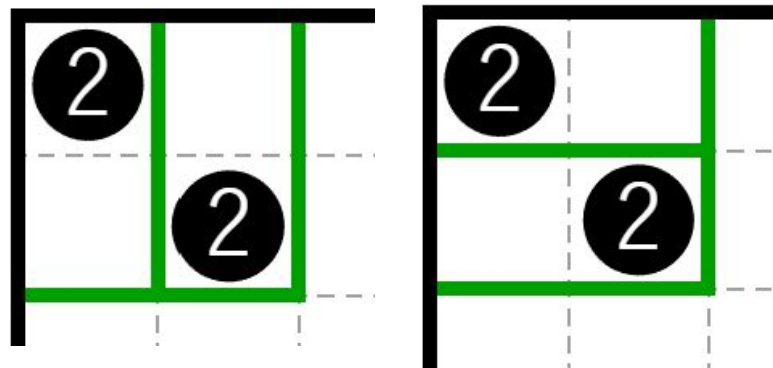
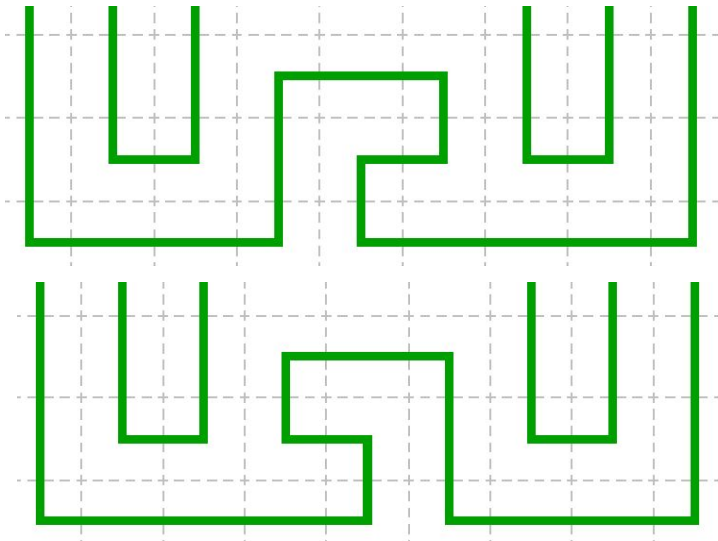


Common Arguments - Uniqueness

- Almost all puzzles guarantee you can “deterministically solve the puzzle”, which actually implies “the solution is unique”; this can be abused
- Argument direction: “If I pick this option, it leads to two indistinguishable configurations left behind, hence this must be wrong”
- Usually used to reject a partial instantiation, i.e. branch cut
- Note that uniqueness is never necessary to solve a puzzle, it is a byproduct of “can solve deterministically”

Common Arguments - Uniqueness

- Some examples of breaking uniqueness:



Shikaku, 2 possible ways to do this 2x2

Simpleloop, 2 possible ways to do this 3x3

Minicomp

- There are 17 different types of puzzles in a single task (IOI mode)
- Subtask scores are roughly logarithmic to my perceived difficulty (solve time)
 - I would recommend attempting the task in ascending order
 - I am equally (un)familiar with the types, I hope the difficulty is correct
- Group into teams of 2
- Top 3 teams will receive some Japanese puzzle books!!!! (given in Day 4)
- GLHF!

Statistics

1.	Nonogram	(1): 20
2.	Shikaku	(2): 20
3.	Numberlink	(2): 12
4.	Circles and Squares	(2): 15
5.	Akari	(3): 19
6.	Skyscrapers	(4): 15
7.	LITS	(4): 17
8.	Masyu	(4): 4
9.	Slitherlink	(5): 9
10.	Yajilin	(6): 4

11.	Pentatouch	(7): 4
12.	Simpleloop	(7): 2
13.	Heyawake	(8): 3
14.	Starbattle	(8): 0
15.	Fillomino	(10): 2
16.	Kakuro	(12): 2
17.	Nurikabe	(15): 0

Rank 1:

PCOI but someone is missing, 51

Rank 2:

umiyuri kaiteitan, 47

Rank 3:

:wilted_rose:, 41

Rank 4 (lost by time):

UsErNaMe, 41

My solve times

Easy puzzles:

Shikaku, 00:35

Numberlink, 01:43

Circles and Squares, 01:59

Akari, 02:07

Medium puzzles:

Skyscrapers, 06:33

LITS, 06:45

Masyu, 07:44

Slitherlink, 10:08

Yajilin, 08:39

Pentatouch, 13:57

Simpleloop, 16:41

Heyawake, 17:14

Fillomino, 18:06

Hard puzzles:

Starbattle, 24:28

Kakuro, 45:34

Nurikabe, (I guessed the
solution...)

Q&A

- Any particular puzzles you want me to go through?
- Any other questions?