STAR BATTLE

ACTIVITY GUIDE

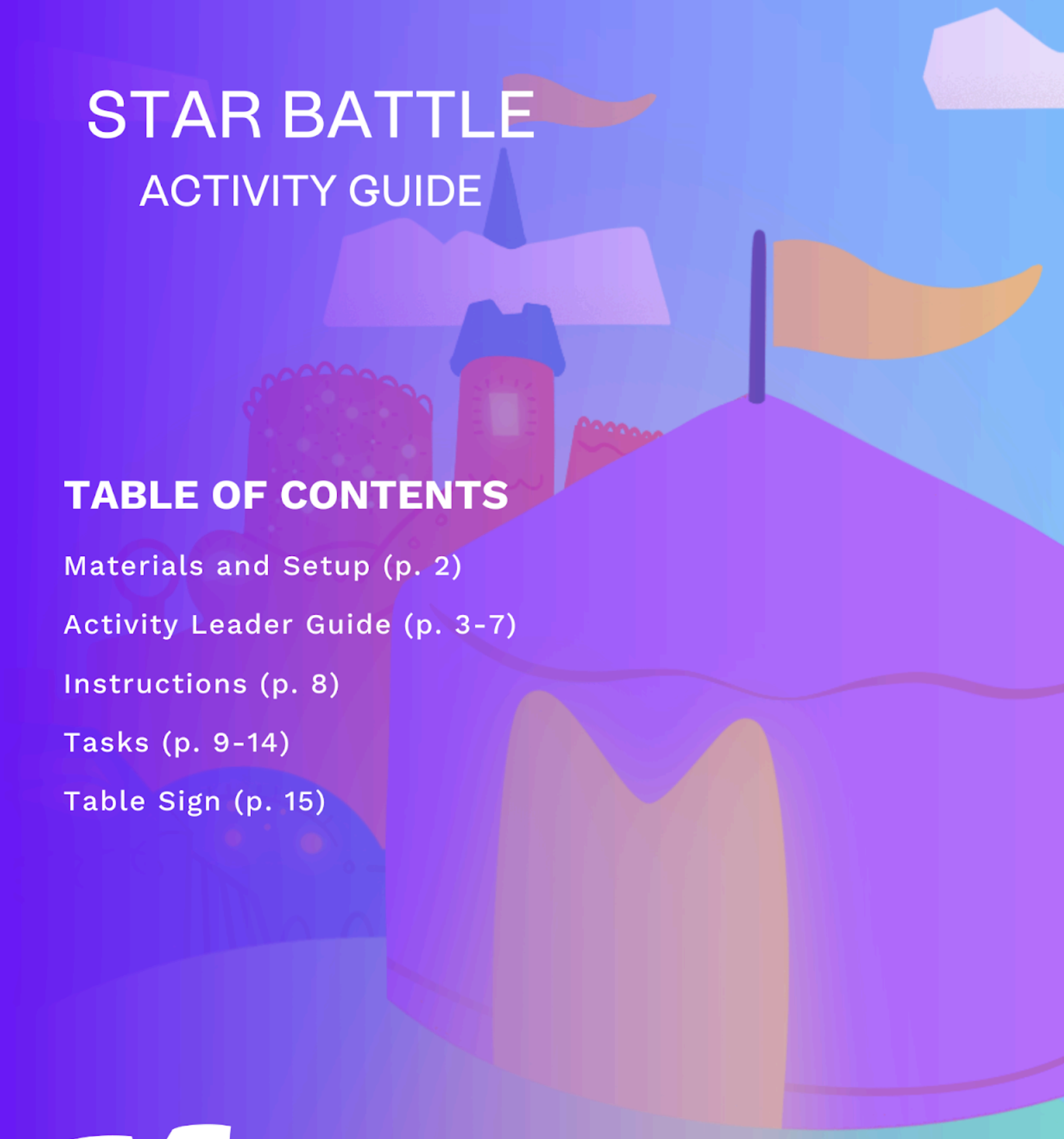

TABLE OF CONTENTS

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Materials and Setup

Per table (assuming 5 students per table), you will need:

Per Table	Material Preparation	
5 sets of stars	Each set requires a minimum of 9 colored stars.	
3 copies of Instructions	1 page each	p. 8
5 copies of Tasks	6 pages each *can be printed double-sided*	p. 9-14
1 copy of Table Sign	1 page *print on cardstock for sturdiness*	p. 15

Per Table	Purchasing Materials		
5 sets of 9 colored stars	pack of 500 for $8.99		All 9 stars in a set must be the same color.
18 plastic sheet protectors	pack of 100 for $7.67	pack of 500 for $26.99	These are recommended in order to protect the documents that students will be handling.

Objective

Place stars on a grid.

Rules:
1. There must be exactly one star per color, row, and column.
2. No stars can touch diagonally.

Materials

Each Star Battle table should be prepped for 5 stations.
Each station needs:
1. At least 9 same-colored stars.
2. Star Battle instructions.
3. Star Battle tasks.

How to Play

We encourage you to explore the activity yourself ahead of time.
You can try our online version here.

Introduce the activity without overexplaining it and without telling what strategies students might want to use. As much as possible, avoid giving away answers. Students should be encouraged to explore, experiment, and learn from their mistakes.

1. Use the first puzzle to demonstrate the rules.
    a. Have the student count/point out all the colors in the grid.
    b. Lay one star in each color and purposefully make some of them touch vertically, horizontally, or diagonally. Point out the stars that break the rules and ask the student if they could find a way to place one star in each color so that none touch.
    c. Clear the grid and ask the student if they can see a square where they are certain a star must be placed. Have them place a star there.
2. Ask the student to try finishing placing the rest of the stars on the puzzle. Encourage them to explain their thinking out loud as they place them.
3. Have the student explore the next puzzles. Point out that for the second page of puzzles, they'll need 5 stars.

Addressing Misconceptions

This section is based on the most common mistake we've seen while students play Star Battle. Showing a clear example before students begin the activity may help avoid this

misconception, but you also want to make sure you are addressing this misunderstanding while students are playing.

Here is the rule that often needs to be reinforced:

1. There must be exactly one star per color, row, and column. Students often think two stars in the same row or column are okay as long as they're not touching.

Beginner Version

See here for a beginner version to engage younger students or students of any age who:

1. Have strong math anxieties
2. Don't feel confident with math or math puzzles
3. Have learning differences
4. Want a gentler start to the activity

Standards

1. Make sense of problems and persevere in solving them. CCSS.MP1
2. Construct viable arguments and critique the reasoning of others. CCSS.MP3
3. Model with mathematics. CCSS.MP4
4. Attend to precision. CCSS.MP6

Asking Good Questions

1. Ask questions about confidence.
    a. When a student asks you "Is this right?", instead of saying "yes" or "no" right away, ask them how confident they are in their answer. Here are some examples:
        i. "Maybe. What do you think? How confident are you?"
        ii. "On a scale of 1-5, how confident are you in your answer?"
    b. If a student is not confident in their answer, follow up by asking "What would help you feel more confident in your answer?" or "Why do you not feel confident?" This helps you determine how best to help the student through their explorations.

2. Ask students about choices.
    a. When a student is stuck or shows you a wrong answer, instead of jumping in and showing the student the correct answer, start by asking about the choices that the student made along the way. Here are some suggested steps to follow:
        i. Start from the beginning.
        ii. Ask students to show you what they've tried so far.
        iii. When the student gets to a point where they have different choices, ask the student "What other choices can you make here?"
        iv. Have the student make a different choice and try to solve the puzzle. This helps the student see that they have the power to make different choices during an activity, and they'll start to do this on their own in the future.

v. If you're familiar with the puzzle or a particular solution, stop the student only when a different choice will help them get to the solution. This will help them feel successful faster without you giving away too much of the answer.

3. Ask students about strategies.
    a. If a student is getting into the activity and has been doing it for a while, ask the student if there are any strategies they've come up with to help them solve the puzzle or win the game.
    b. Follow up by asking if they think their strategies will work for all puzzles and/or larger puzzles, more complex puzzles, etc. Have the student explore more complex puzzles to test out their strategies.
    c. This is a great way to encourage a student to dive deeper into an activity and to start looking for patterns, structure, and proofs.

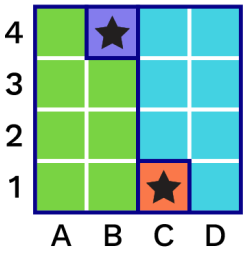
Answers

General Strategies:

Many students will start by placing one star in each color and then shifting the stars around until all of the rules are followed. However, there are a few general strategies that can help students who are stuck or who want to solve Star Battle puzzles faster.

1. As much as possible, don't make any guesses. In other words, only place a star if you know it must go there.

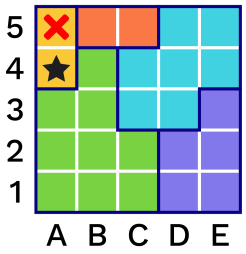
Puzzle 1



Because every color needs one star, start Puzzle 1 by placing a star on B4 and C1. This makes it much easier to figure out where the green and blue stars should go.

2. Sometimes, it can be helpful to look for where a star **can't** go.

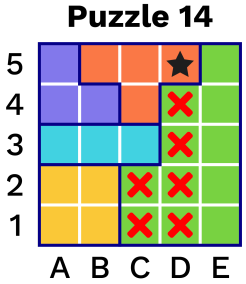
Puzzle 12



The orange star must go on either B5 or C5. Because there can only be one star in Row 5, this means that the yellow star cannot go on A5. So, the yellow star must go on A4.

3. Sometimes, it can be helpful to look at the number of colors in a row or column.

Puzzle 14



Column E has only one color – green. This means that the green star must be in Column E and cannot be in Columns C or D. There must be a star in Column D, so the star in Column D must be on D5.

4. This isn't an exhaustive list of Star Battle strategies but should help out with most puzzles. Students should be encouraged to come up with their own strategies and explanations.

Puzzle Solutions:

Puzzle 1

Puzzle 2

Puzzle 3

Puzzle 4

Puzzle 5

Puzzle 6

Puzzle 7

Puzzle 8

Puzzle 9

Puzzle 10

Puzzle 11

Puzzle 12

Puzzle 13

Puzzle 14

Puzzle 15

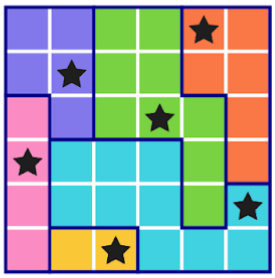
Puzzle 16

Puzzle 17

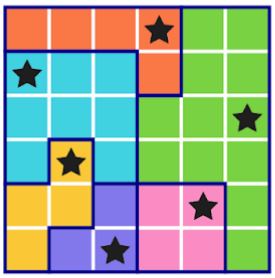
Puzzle 18

Puzzle 19

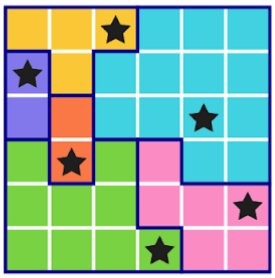
Puzzle 20



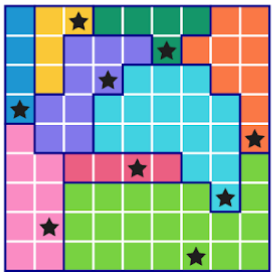
Puzzle 21



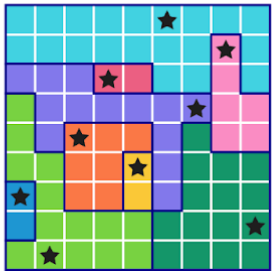
Puzzle 22



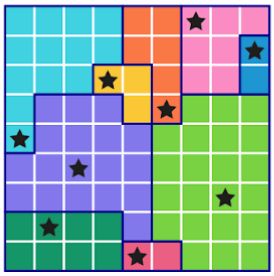
Puzzle 23



Puzzle 24



Puzzle 25



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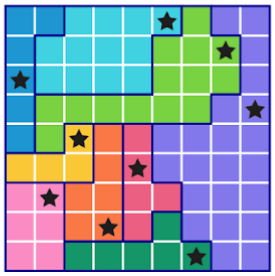

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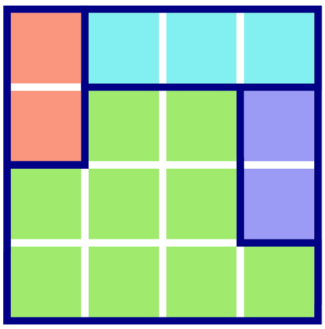
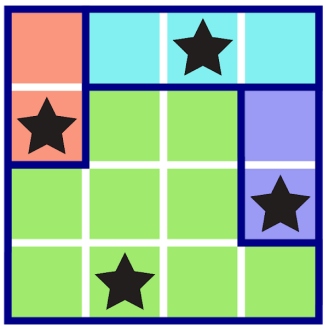
Star Battle Instructions

Can you place four stars in each puzzle?

Puzzle

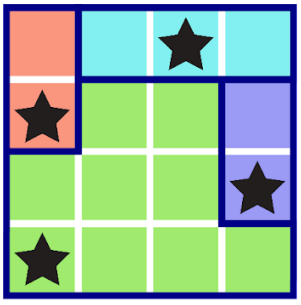


Solution

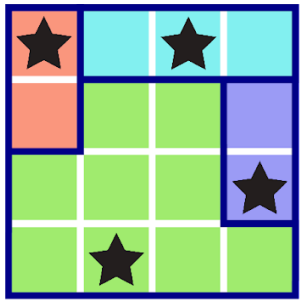


Rules:

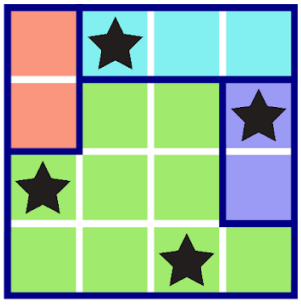
- There needs to be one star in every row, column, and color.
- Stars cannot touch diagonally.



A column cannot have two stars.



A row cannot have two stars.

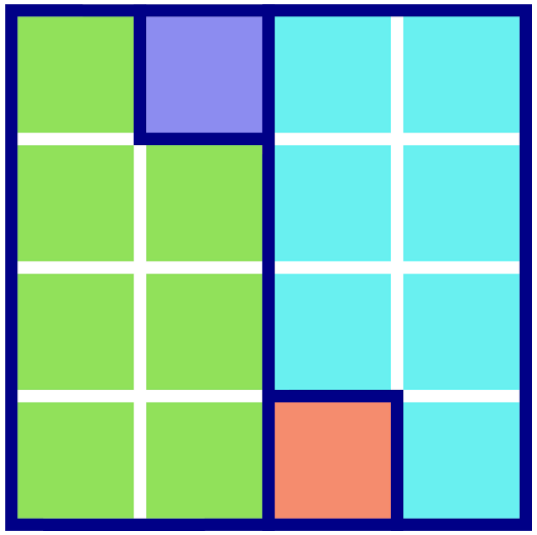


Green cannot have two stars.

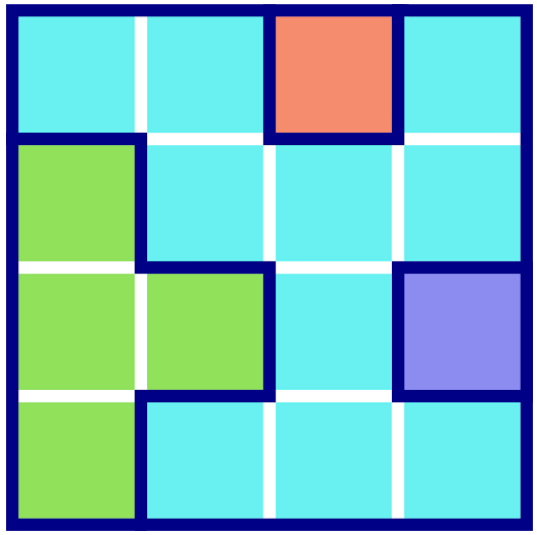
Stars cannot touch diagonally.

Star Battle Tasks

Puzzle 1



Puzzle 2



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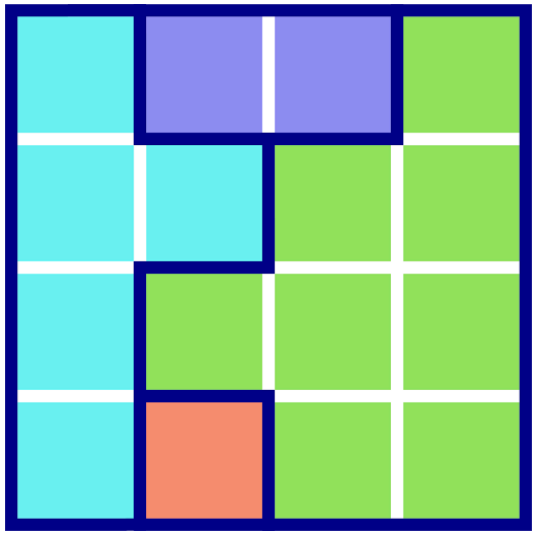

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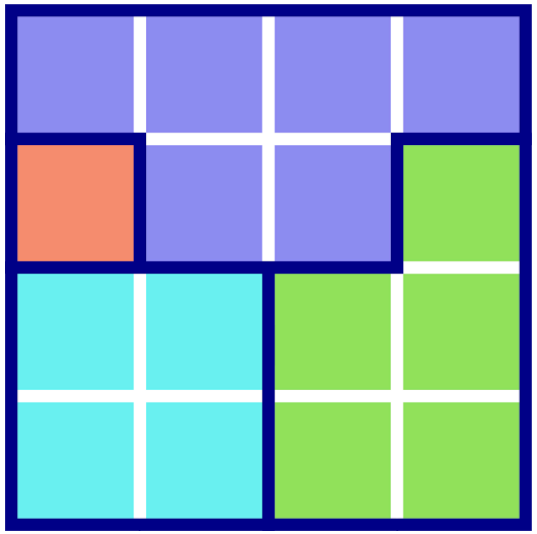

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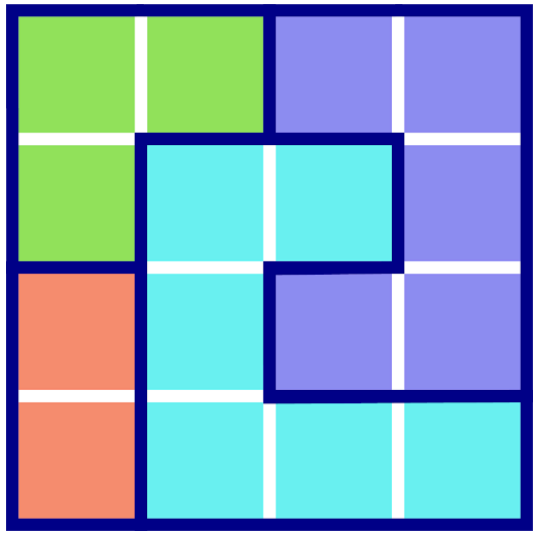

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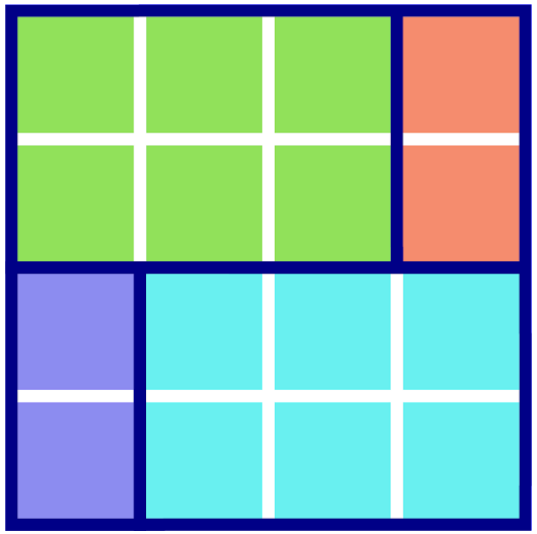
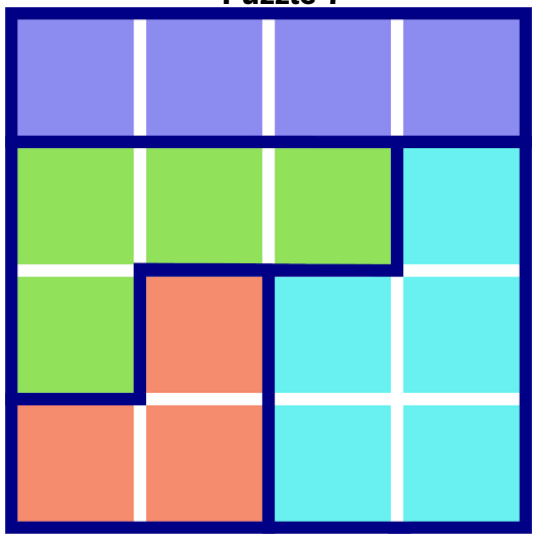


Star Battle Tasks

Puzzle 7



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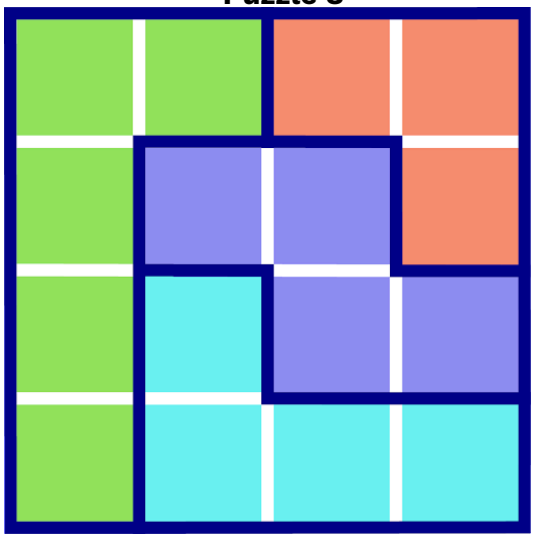

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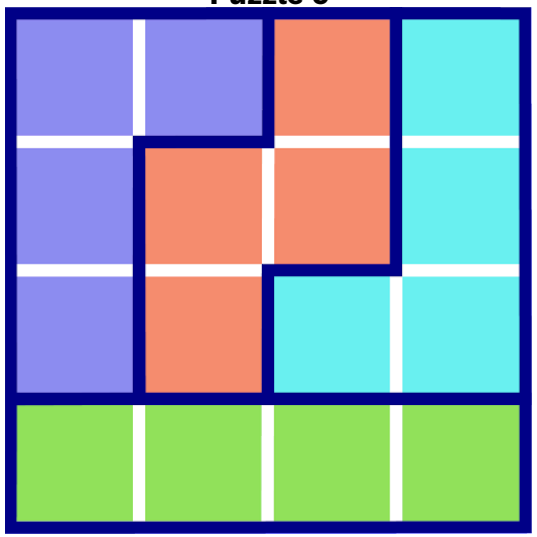

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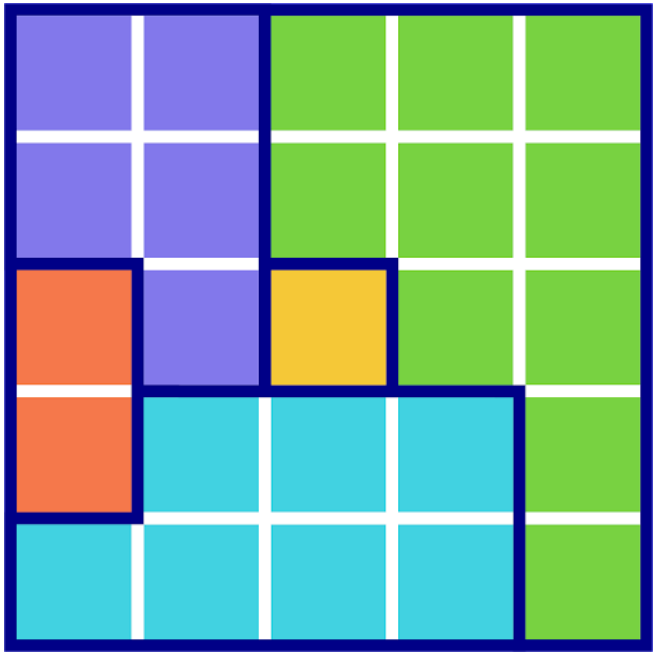

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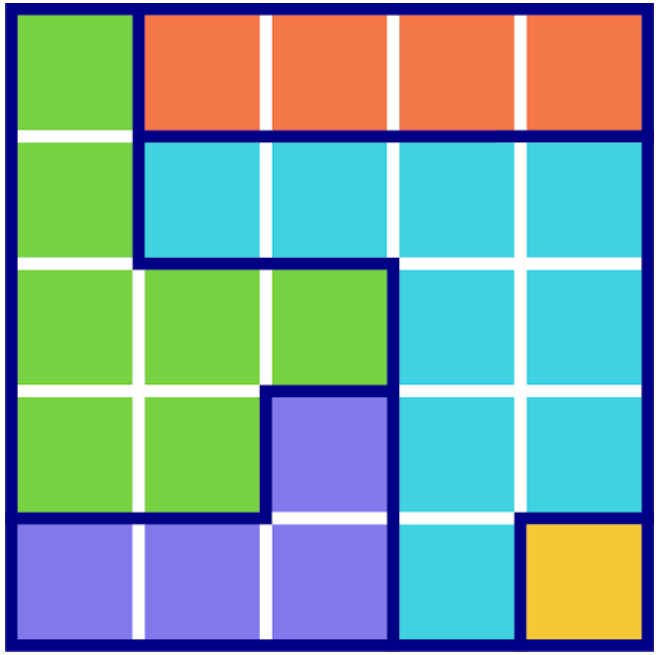

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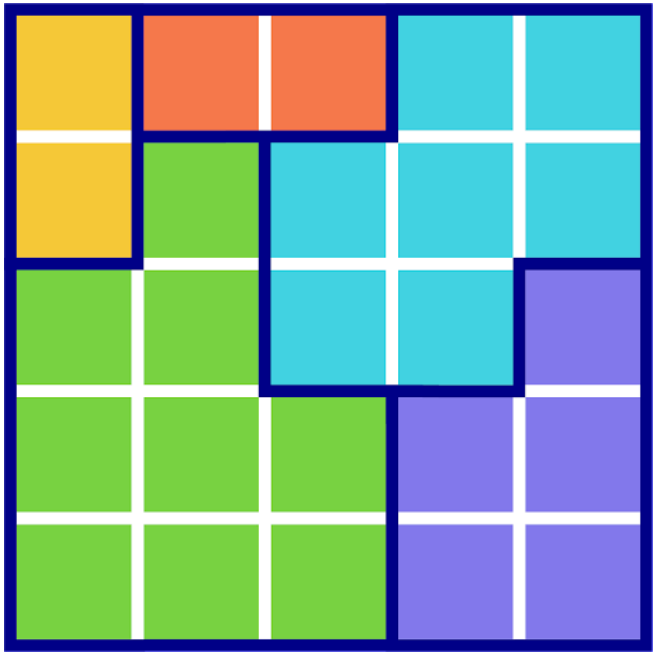

Star Battle Tasks

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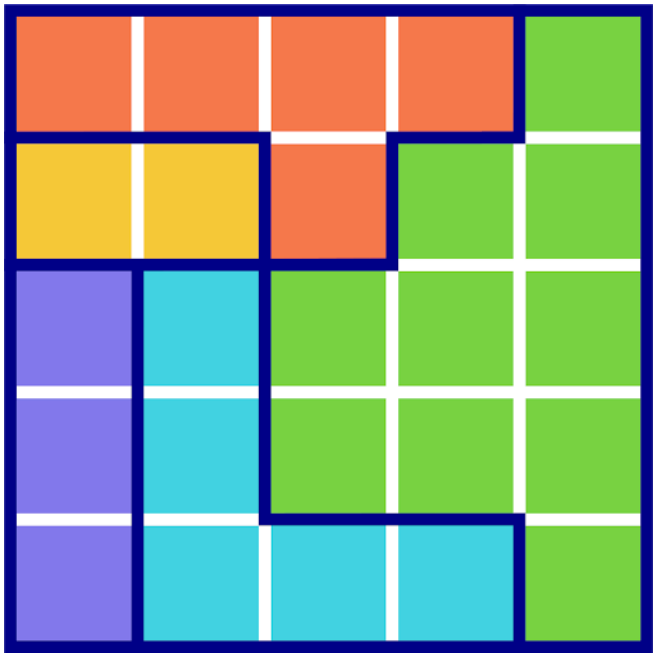

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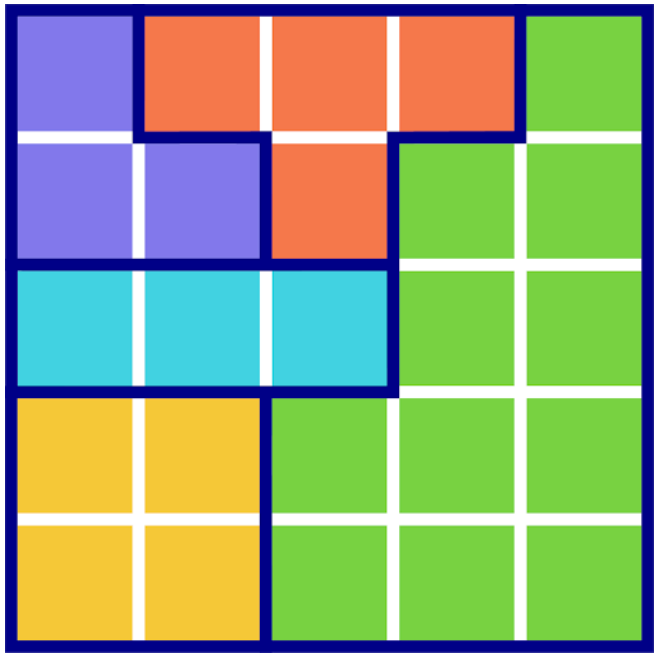

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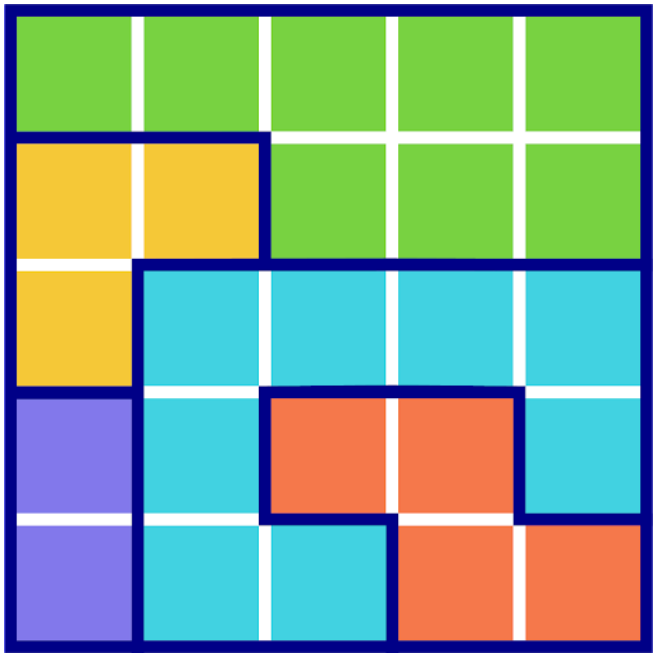

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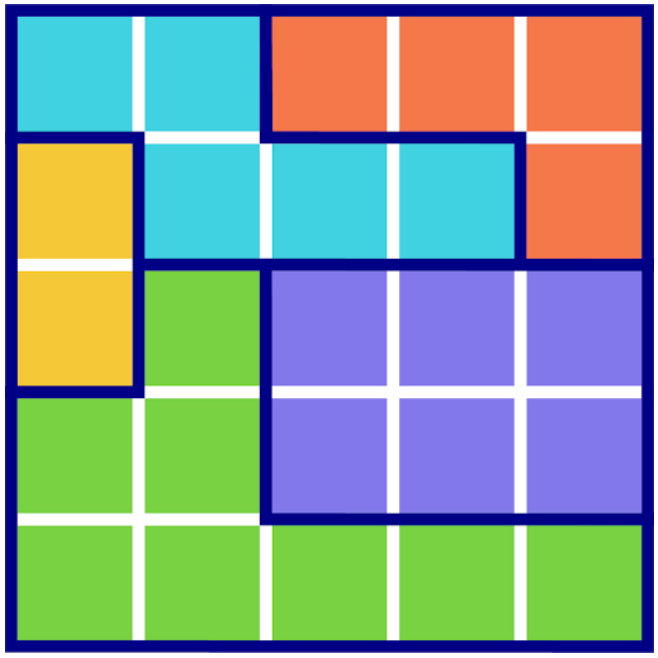

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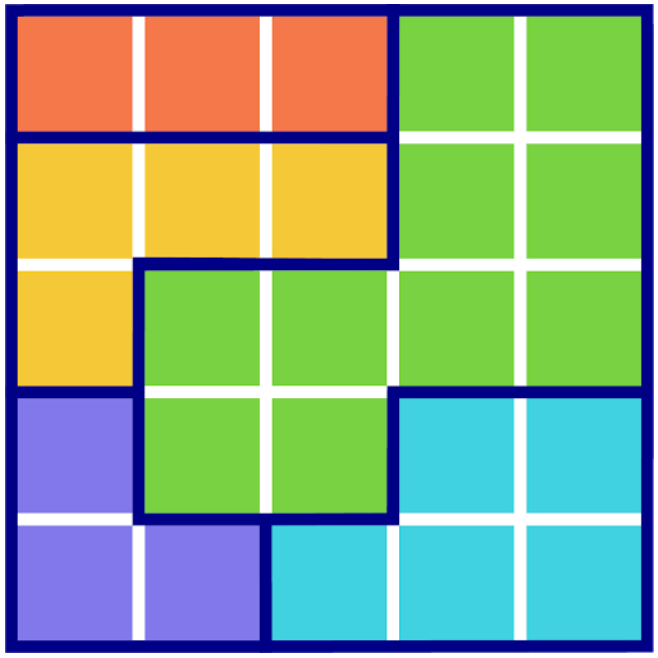

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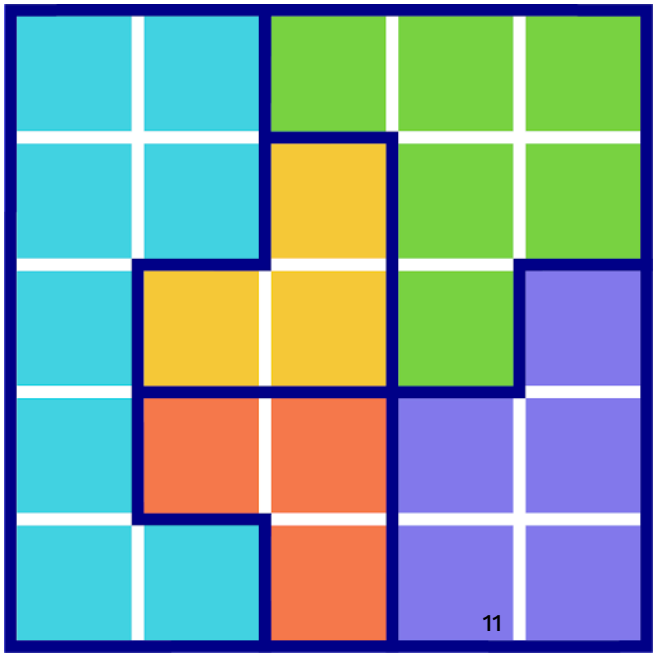
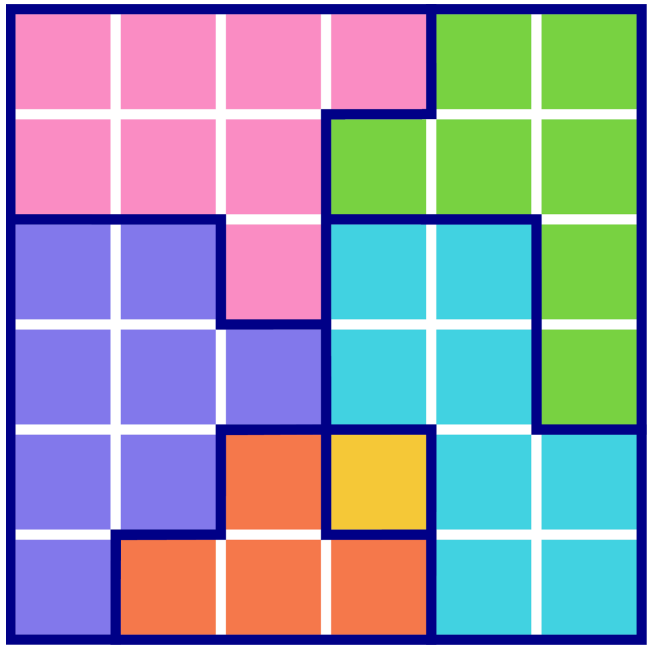


Star Battle Tasks

Puzzle 19



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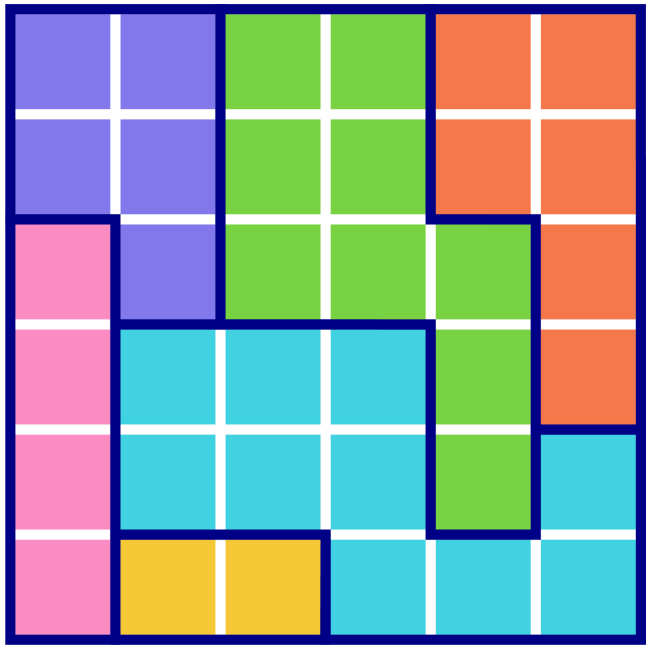

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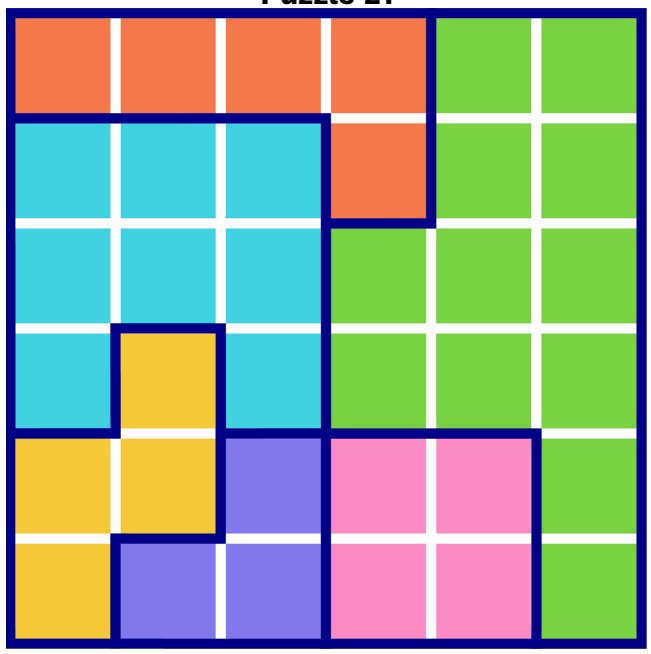

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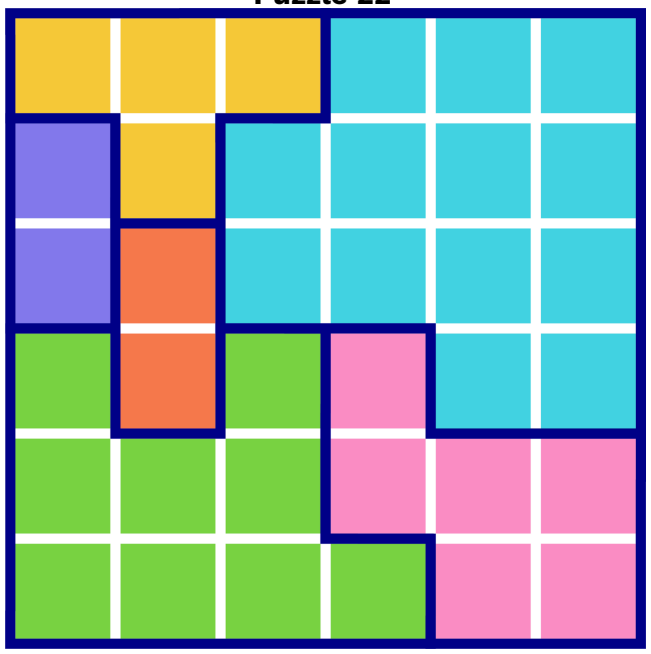
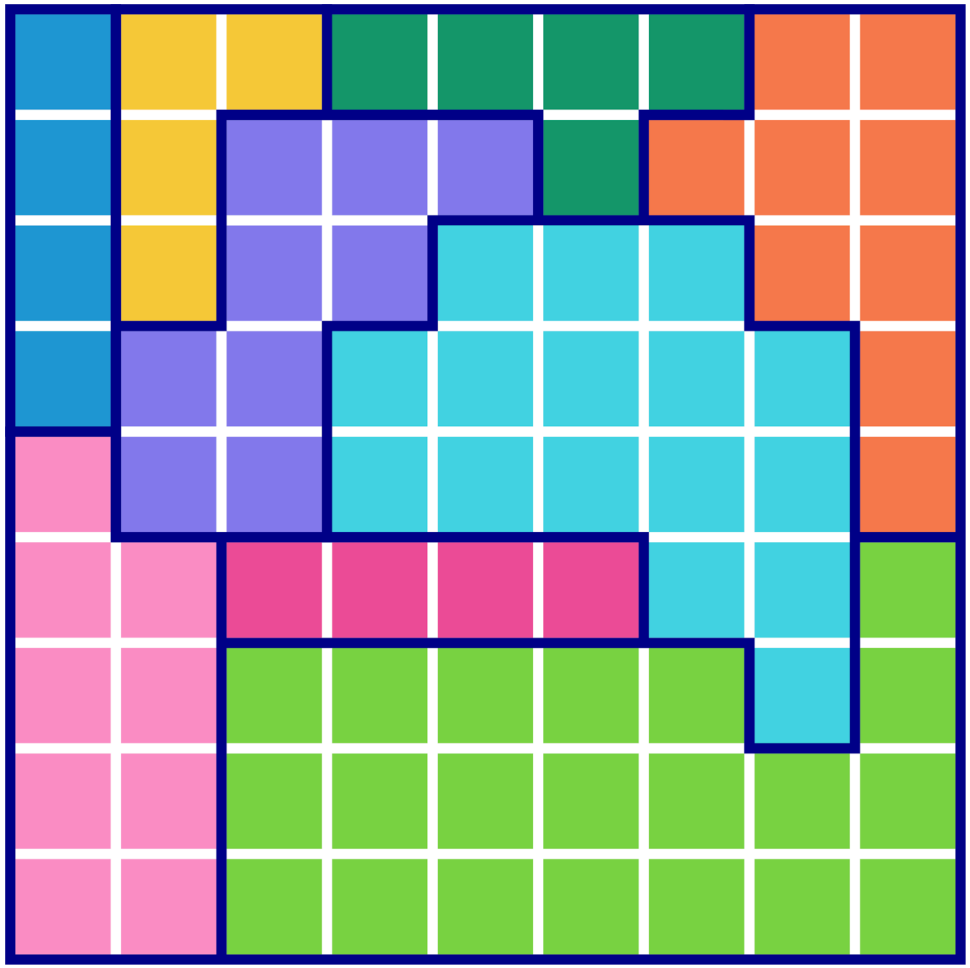


Star Battle Tasks

Puzzle 23



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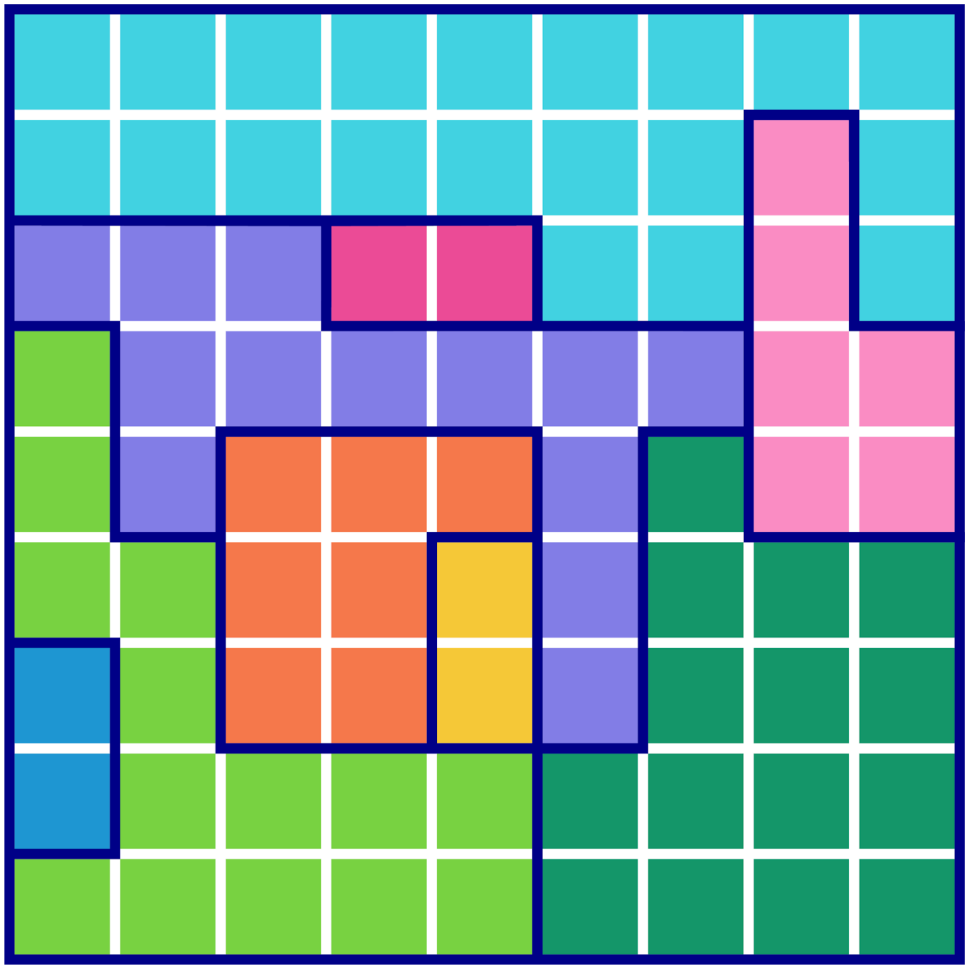
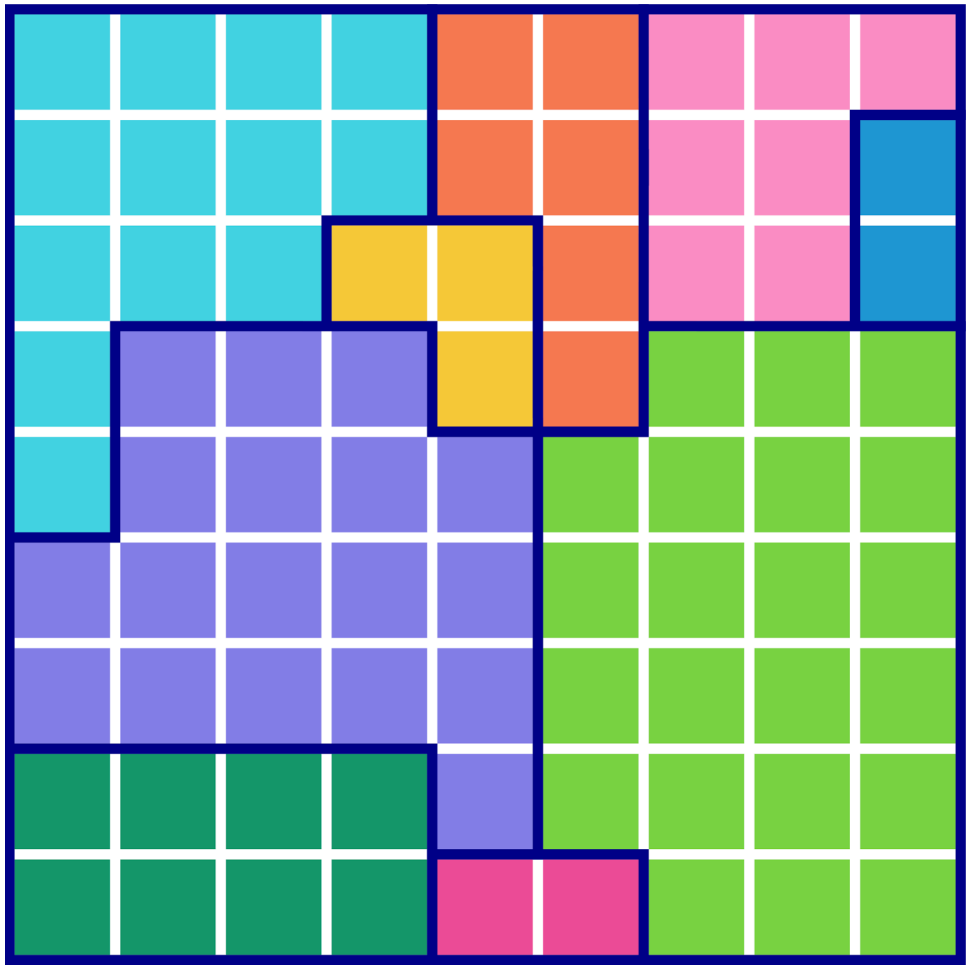


Star Battle Tasks

Puzzle 25



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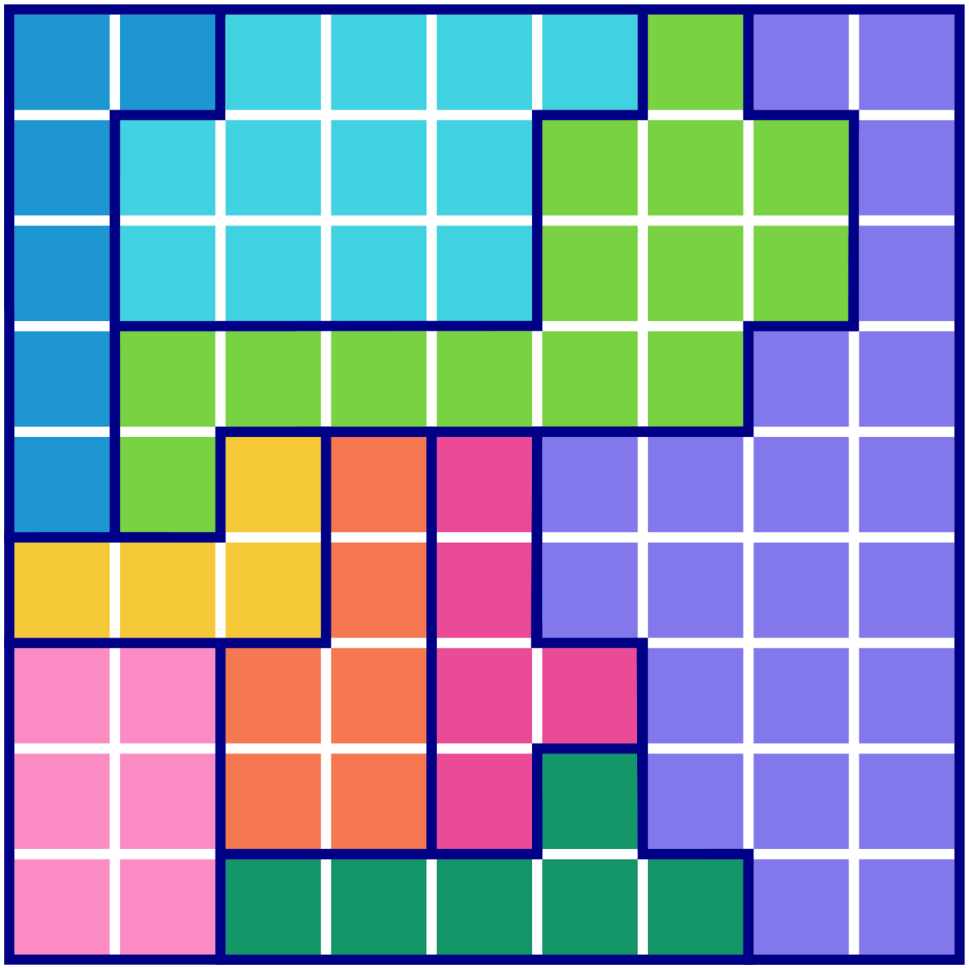

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