APPLE PICKING

FESTIVAL GUIDE

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Julia Robinson Mathematics Festival

Materials and Setup

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

Per Table	Material Preparation	
3 copies of Instructions	2-page sheet *can be printed double-sided*	p. 7-8
5 copies of Tasks	2-page sheet *can be printed double-sided*	p. 9-10
100 Apple Cards	Print Apple cards double-sided and then cut out.	p. 11-12
1 copy of Table Sign	1-page sheet *print on cardstock for sturdiness*	p. 13
Paper and pencils		

Per Table	Purchasing Materials		
8 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

The goal is to be the player who eats the last apple.

Rules:
1. Players take turns eating apples by flipping over the cards.
2. On each turn, they can choose to eat one apple or two apples.
3. When eating two apples, the two apples must be next to each other.

Materials

Each Apple Picking table should be prepped for 5 stations of two students.
Each station needs:
1. 20 apple cards.
2. Apple Picking instructions.
3. Apple Picking tasks.
4. Paper and pencils for tracking moves.

How to Play

We strongly encourage you to explore the activity yourself ahead of time.
You can try our digital version here: jrmf.org/puzzle/apple-picking

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. Demonstrate the rules by playing a game with the student (or pair of students).
2. Encourage them to explain their thinking out loud as they choose which move to make.
3. Have the student explore the game, starting with the row of 4 apples. Apple Picking is a 2-player game, so collaborating with a partner is preferred, but the game can also be played with an imaginary partner.
4. Encourage older students to explore the 2D version.

Addressing Misconceptions

This section is based on the most common mistakes we've seen while students play Apple Picking. Showing a clear example before students begin the activity addresses many misconceptions, but you also want to make sure you are addressing misunderstandings while students are playing.

Here is a list of rules that are either implicit in the instructions or often need to be reinforced:

1. Apples can be eaten anywhere in the row. Students do not need to go from left to right.
2. When students eat two apples, they must be right next to each other. Students cannot eat two apples that are not next to each other.
3. Apple cards cannot be flipped more than once. Once an apple is eaten, it cannot be uneaten.

Exploring with Younger Children
To make the activity more accessible for younger or struggling students:

Remove a rule:

- Allow flipping two apples that are not right next to each other.

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. Look for and make use of structure. CCSS.MP7

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 Answers for Apple Picking (*Please don't share these strategies with students!):*

- Player 1 can always win by using the following strategy:
  a. Player 1 eats the middle apple (if there is an odd number of apples) or the middle two apples (if there is an even number of apples).
  b. For the rest of the game, Player 1 mirrors Player 2's moves across the middle.

General Answers for 2D Apple Picking:

- If the number of rows and/or columns is odd, Player 1 can always win:
  a. Player 1 eats the middle apple (if the number of rows and columns are odd) or the middle two apples (if one dimension is odd and the other is even).
  b. For the rest of the game, Player 1 mirrors Player 2's moves across the middle.
- If both the number of rows and columns is even, Player 2 can always win:
  a. Player 2 mirrors Player 1's moves across the middle.

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This activity was made in collaboration with sfmathcircle.org

Apple Picking Instructions

Goal: Be the player who eats the last apple.

Take turns eating apples by flipping over the cards.

Each turn, you can choose to:

Eat 1 apple

OR

Eat 2 apples next to each other

The winner is the player who eats the last apple.

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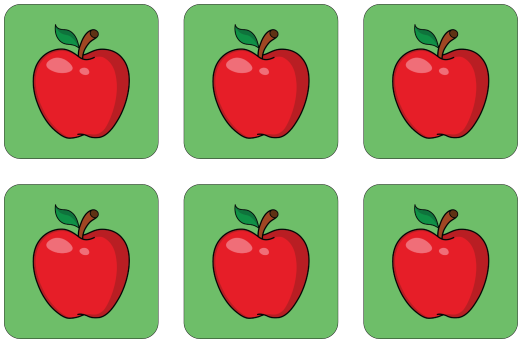
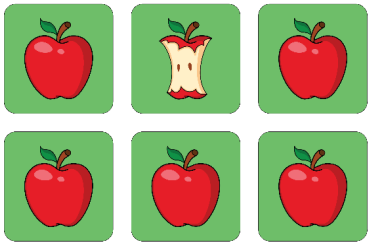
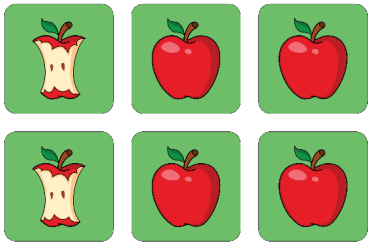
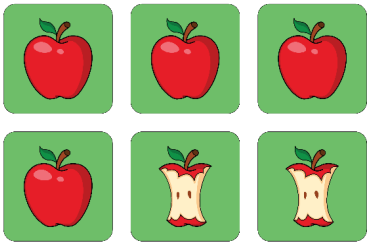
2D Apple Picking Instructions

Goal: Be the player who eats the last apple.



Take turns eating apples by flipping over the cards.

Each turn, you can choose to:

Eat 1 apple	OR	Eat 2 apples on top of each other	OR	Eat 2 apples next to each other
				

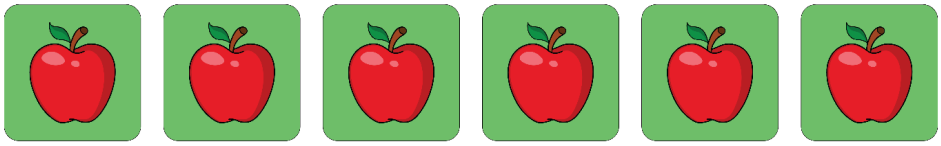
The winner is the player who eats the last apple.

Apple Picking Tasks

1. Start by making a row of apples that look like the picture.
2. Can you find a strategy that helps you win every time?
3. Does it matter if you go first or second?

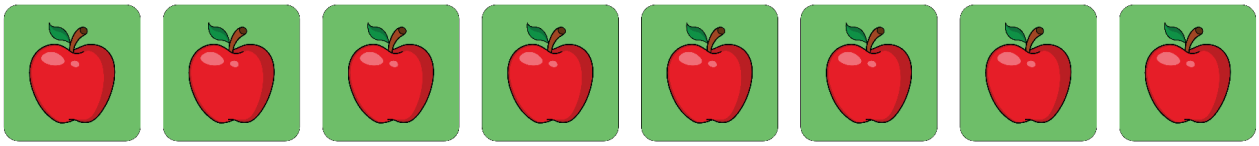
Game #1

Game #2



Game #3

Game #4

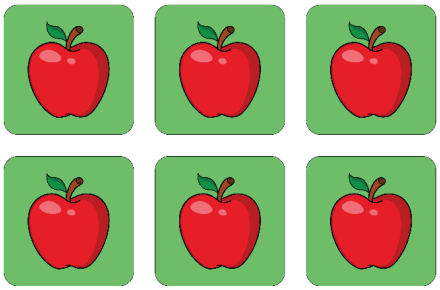


Game #5

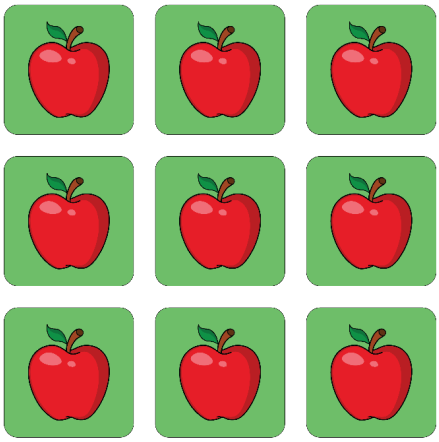
2D Apple Picking Tasks

1. Start by making a grid of apples that look like the picture.
2. Can you find a strategy that helps you win every time?
3. Does it matter if you go first or second?

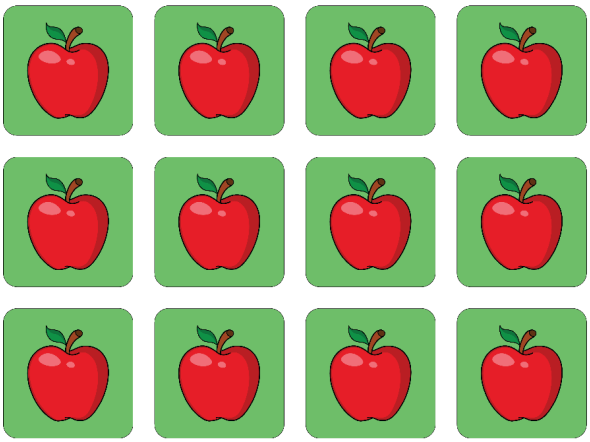
Game #6



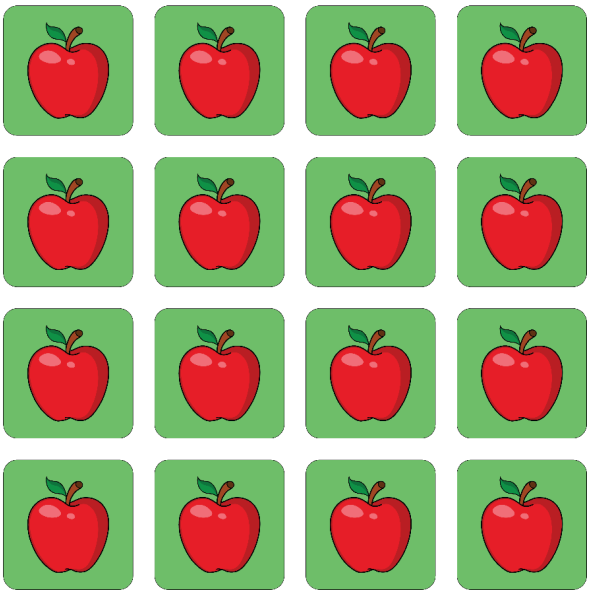
Game #7



Game #8



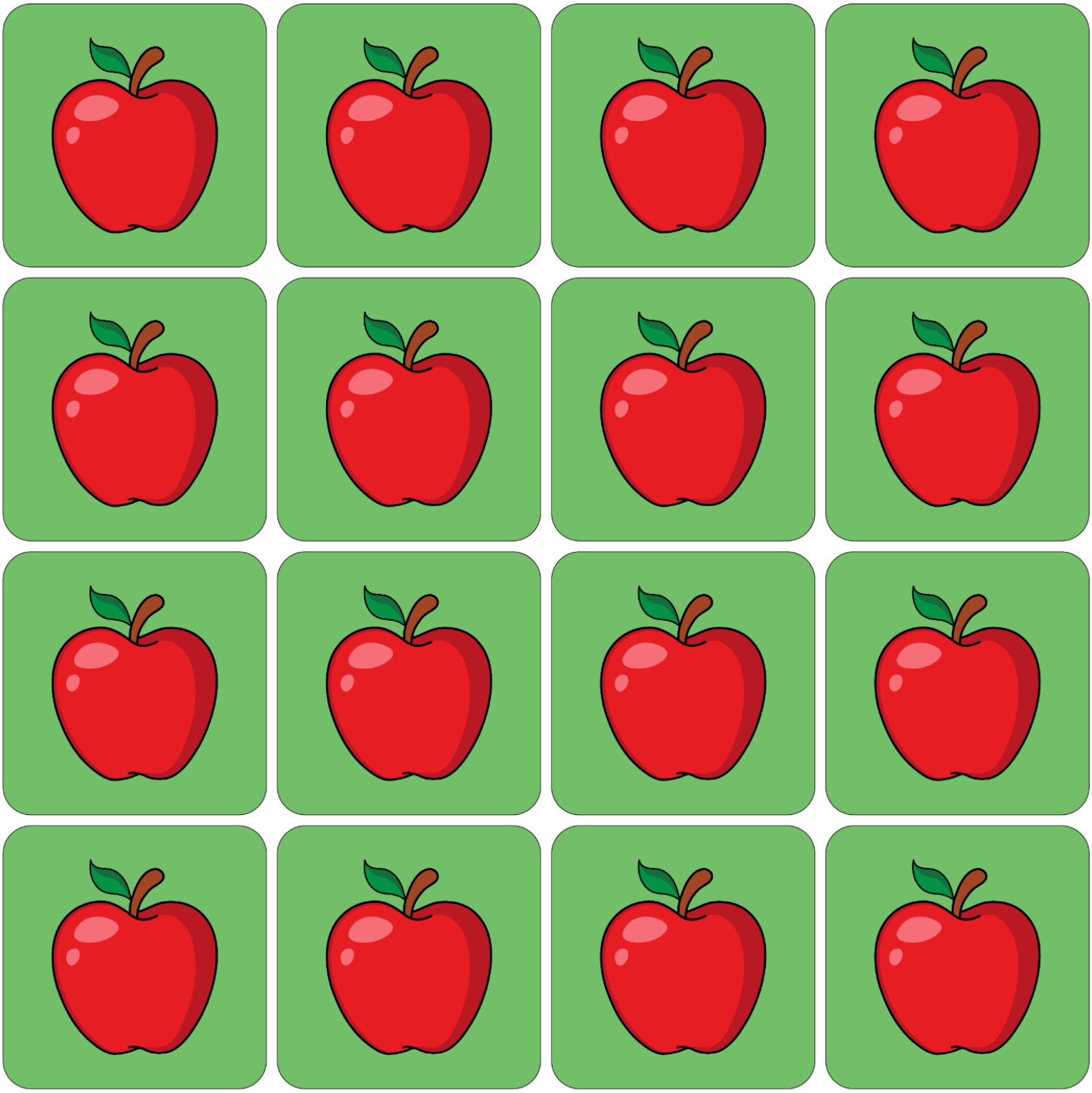
Game #9



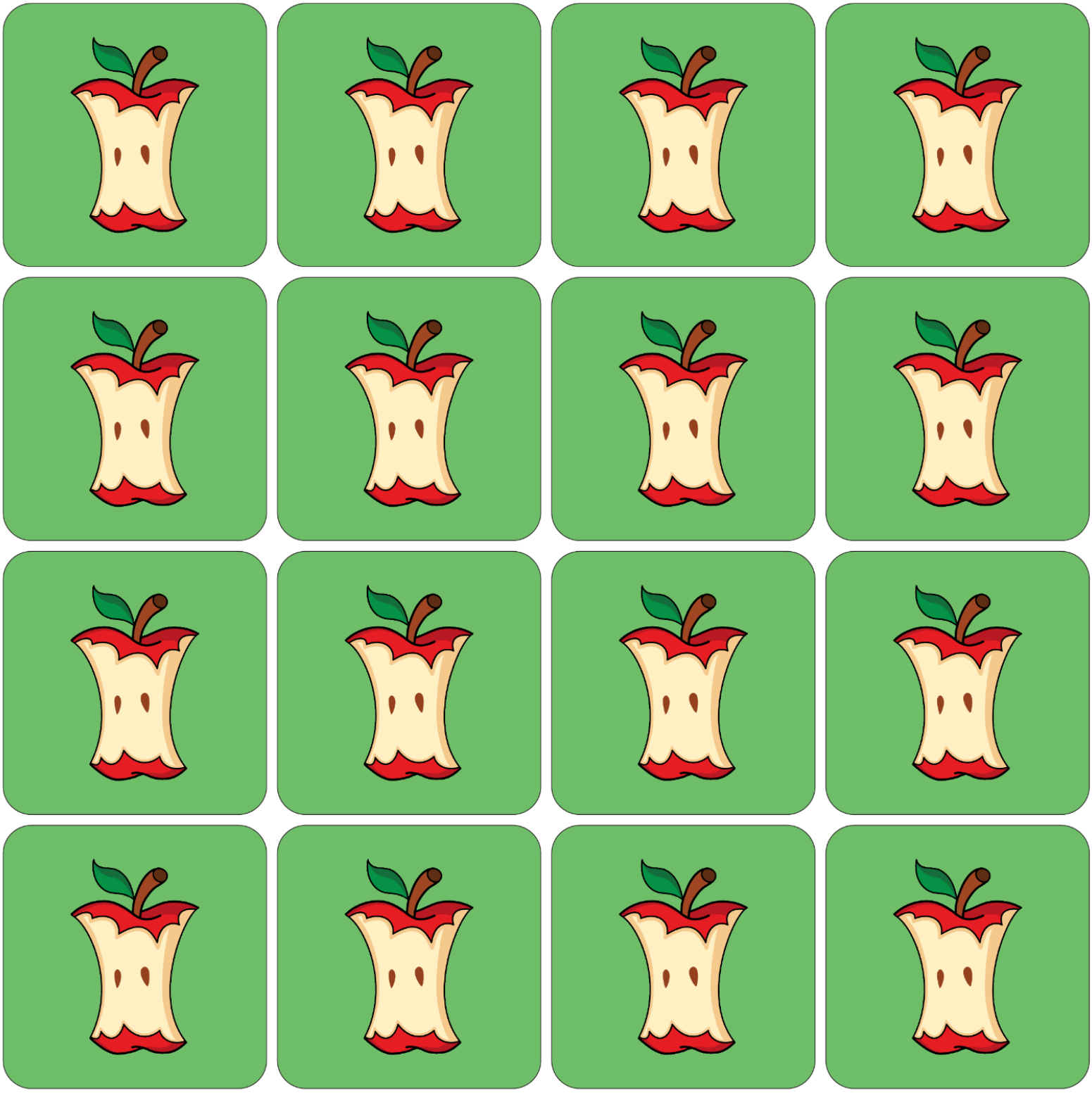
Make your own Apple Picking game.

Can you find a strategy that helps you win every time?

Apple Picking Cards (Front)



Apple Picking Cards (Back)



Play for free at
jrmf.org/puzzle/apple-picking

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