Logical Mixed Up Dots

Educator's Guide

Overview

CS Hands-On is a 501(c)(3) nonprofit teaching computational thinking skills through technology-free lessons and activities. This curriculum is built to teach fundamental computer science concepts in an engaging, hands-on way. In this mission, students use logical operators to analyze a playground scene and decode a dot-to-dot drawing.

Prerequisite Knowledge

Student should have completed the Binary Pixel Art activity which introduces the binary number system and the Relational Mixed Up Dots activity which covers relational operators.

Lesson Details

Travelling to Logicland, students will learn to break problems down into smaller parts with Lex. Students will learn how to make decisions using logical operators to analyze a playground scene and decode a dot-to-dot drawing.

This lesson was developed for students ages 6 to 12 and can be modified for all skills and ages. This lesson takes around 30 minutes.

Learning Objectives

Key Question

How can we make decisions using logical operators?

Key Terms

Logical Operator: Symbols used to compare and evaluate one or two expressions. Types of logical operators include and, or, and not.

Curriculum Standards

Students should be able to...

- Explain and compare expressions with logical operators (Logic)
- Read and interpret logical operators (Literacy)
- Use logical operators to solve a dot-to-dot drawing (Creative Arts)

View standards addressed here

Lesson Plan

Materials

- Logical Mixed Up Dots worksheet (per student)
- Writing utensil: Markers, pencils, pens, etc. (per student)

Setup

- Hand out a Logical Mixed Up Dots worksheet to each student
- Set up your classroom to have students sitting individually or in groups

ANSWER KEY & LESSON ANNOTATIONS

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Name: _____ Date: _____

Logical Mixed Up Dots

Fun Choices at Logicland

Believe it or not, we make thousands of choices every day, from our outfits to the sports we play. Get ready to explore more logic with Lex to use in your the decision-making process!

What are Logical Operators?

A **logical operator** compares either one or two statements to produce a true or false value. Three types of logical operators are **and**, **or**, and **not**.

The and operator

The **and** operator compares **two** statements to produce a true or false value.

	A **and** B
A **B**	✓ **True**
A **B**	✗ **False**
A B	✗ **False**
A B	✗ **False**

Black = true **Gray = false**

A **and** B equal **true** only when **both** A and B are true

A **and** B equal **false** when **one or more** statements are false

Statement A and Statement B each represent true or false expressions. For example, these expressions can be anything from "1 < 2" to "today is Monday."

CS Hands-On Logical Mixed Up Dots 1

Reflect

Compare and contrast the three logical operator tables (continued on the next page). What differences and similarities are there?

Differences:

- A and B are only true if both are true, whereas A or B is only false if both are false.
- The 'not' operator only evaluates one expression, while the 'and' and 'or' operators evaluate two expressions.

Similarities:

- All three logical operators produce a true or false value.

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The or operator

The **or** operator compares **two** statements to produce a true or false value.

	A **and** B
A **B**	✓ **True**
A **B**	✓ **True**
A B	✓ **True**
A B	✗ **False**

A or B equals **true** only when **one or more** statement is true

A or B equals **false** only when **both** statements are false

The not operator

The **not** operator evaluates **one** statements to produce a true or false value.

	not A
A	✗ **False**
A	✓ **True**

not A equals **false** when statement A is true

not A equals **true** when statement A is false

No More Rainy Dilemmas

Surprisingly, we use logical operators daily! Logical operators allow us to make decisions from a set of conditions. Check out how Lex's uses logical operators on a rainy day.

At Logicland, Lex hates getting drenched by rain! Because of this, Lex uses the following logical statement:

> If it's raining **and** Lex needs to go outside, Lex brings an umbrella and wears boots.

CS Hands-On Logical Mixed Up Dots 2

Reflect

What other ways can we use logical operators in our daily life? Examples can be if 'I have a stuffy nose' **or** 'I have a mild fever,' I may have a cold.
Another example is if I am going outside and it is sunny outside, I need to bring a pair of sunglasses.

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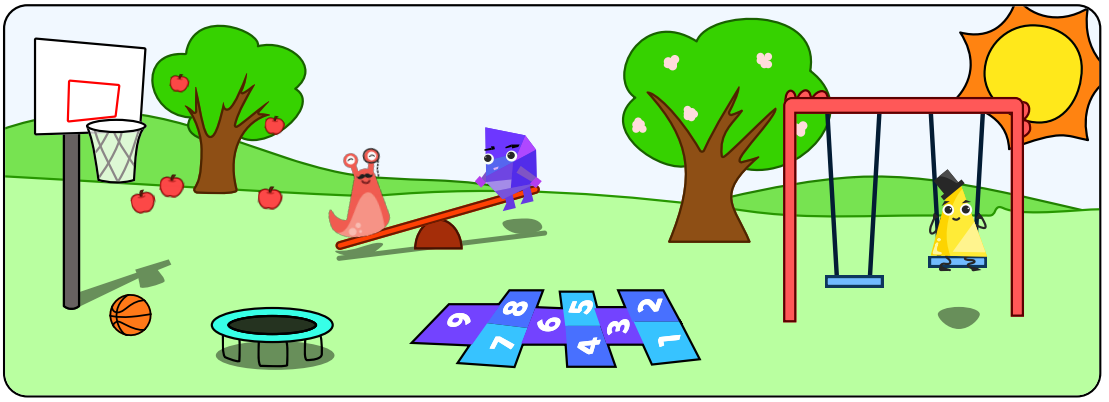
Mixed-Up Mysteries

On one windy day, the wind blew Lex's numbered puzzle all over Logicland Playground! Now, the numbers are all mixed up and out of order. Using your knowledge of logical operators, use the following image to solve the mixed dot-to-dot puzzle!



Clue Bank

1. If there is a trampoline **and** there is a bicycle connect 9 and 43
2. If there is an apple tree **or** there is a banana tree, connect 32 and 10
3. If there are five trees **or** there are two trampolines, connect 32 and 28
4. If there are two trees **and** no one is on the trampoline, connect 37 and 2
5. If one swing is being used **or** it is raining, connect 12 and 24
6. If there is a tennis court **or** there is a baseball field, connect 2 and 28
7. If the swings are **not** to the left of the hopscotch, connect 24 and 37
8. If the seesaw is **not** in being used, connect 77 and 9
9. If it's sunny **and** no one is playing basketball, connect 28 and 10
10. If it is snowing **and** it is nighttime, connect 37 and 12
11. If the seesaw is being used **and** if there is a basketball, connect 9 and 2
12. If three apples did **not** fall off the tree, connect 10 and 43
13. If there is a hopscotch **or** there is a basketball, connect 77 and 43
14. If there is **not** someone playing basketball, connect 28 and 43

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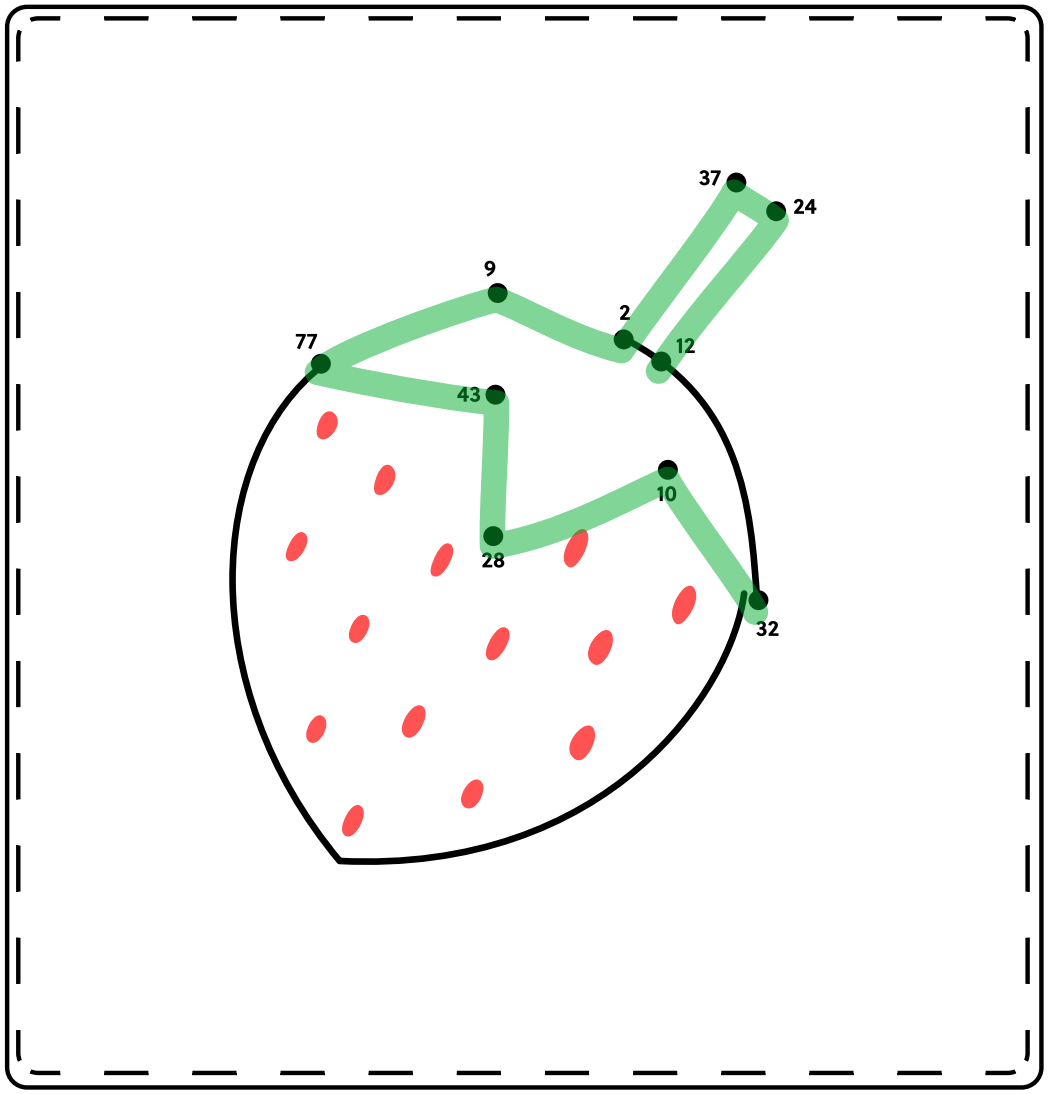

Wrap up & reflect

Group students into pairs and have them discuss the following reflection questions. Afterwards, have students share their ideas as a class.

- Why are logical operators important to use? Provide examples.

  Like relational operators, logical operators help us make decisions based on certain conditions by producing true or false values we can use to make conclusions from.

  For example, we can use them to detect if we are ready to go to school using 'I have brushed my teeth' and 'I have put my school supplies in my backpack.'