

Ozobot Binary Number Activity

Innoworks Summer Camp

Girls Who Code DCMB

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Set up Ozobot and Ozoblockly

1. Download the Evo App (<https://ozobot.com/play/apps>)
 - a. Open the App
 - b. Select the orange button Join and create an account
2. Download the decimalBinaryConverter_Blanks.ozocode from your email
3. On a computer, visit <https://ozoblockly.com> (Google Chrome works best)
 - a. Select Get Started
 - b. On the far right panel login with your new account credentials
4. Under My programs, select an empty box
 - a. You will be prompted to Save program. Name it "decimalBinaryConverter_Blanks"
 - b. Select the folder on the bottom
 - c. Select Open file, then navigate to the .ozocode file on your computer and press open
 - d. Select Save
 - e. You will be prompted "Are you sure you want to save over this program?" Select Yes.
5. You are now ready for the activity (see below)

Objective

Use Ozobot to reinforce concepts of Boolean values and binary numbers where 0 is False and 1 is True. Use conditional statements and logic to accomplish the activity's goal of making the Ozobot follow the correct path and convert the given decimal number to binary.

Materials

Each group of 2 should have

- Ozobot
- Color print out of the track
- Computer with the ozocode loaded into Ozoblockly.com
- Optional
 - Pack of markers (red, green, blue, black)
 - Set of white labels to fix mistakes
 - Chargers to charge Ozobots
 - Extra blank sheets of paper

Activity

First, how does Ozobot work? Ozobot follows lines and has sensors to identify the line color. Ozobot can sense black, green, red, and blue colored lines. If Ozobot reaches the end of the line, it stops moving forward. When Ozobot reaches an intersection, it will randomly choose a direction unless told otherwise. Ozobot listens to directions by executing code that you write with Ozoblocky.

Today we will use the power of code to turn our Ozobots into mathematicians! In this activity you will learn about binary numbers, how computers use them, and how to convert between decimal and binary. You will also code Ozobots to use a decimal to binary converter to check your answers. To create your decimal to binary converter, use what you've learned about binary numbers, Boolean values, and conditional statements.

The code is written but has blank conditional statements. However, the building blocks needed to complete the code are laid out. Students must fill in the conditional statements and color in the blanks and to make the Ozobot turn the correct direction, depending on whether the binary number place value is zero or one.

They can test their robot by placing the Ozobot on the track and executing the completed version of decimalBinaryConverter_Blanks.ozocode.

If students have time at the end, they can create their own Ozobot tracks and code.

Facilitate the activity

1. Split students into groups of 2 with one Ozobot per group
2. Review how the Ozobot senses colors and follows lines
3. Questions and prompts to guide problem solving (before looking at the code):
 - a. Which direction should Ozobot turn if the binary place value is a zero? A one?
 - b. Brainstorm how you can make the Ozobot do this.
 - c. How can you use conditional statements to achieve your goal?
 - d. Students should write pseudocode using conditional statements in their lab notebooks
4. Look at the code as a group.
5. Students should figure out what the code is doing and then complete the conditional statements using the blocks available.
6. Students should choose a decimal number (up to 3 decimal place values) to convert to binary and hard code it into the code. After finishing the code, your track is ready for testing!
7. Turn on your Ozobot
8. Click on the "FLASHING" tab at the bottom left of the webpage
9. Calibrate the Ozobot. See how to calibrate by clicking on "Get Help"
10. Follow the instructions on the screen to load the code onto your Ozobot.

- a. Place the bot on the white mark
 - b. Click load
 - c. Hold the Ozobot still until loading is complete. This will take about 2 minutes.
 - i. While the Ozobot is loading, have the group figure out what the decimal number is in binary
11. Place the ozobot on the track
12. Double-click the button on the ozobot to run the program to see if you converted the decimal number to binary correctly!

Tips and Tricks

- When you open the .ozocode file you may need to scroll around or zoom out to find the code on your screen
- You can view the Ozoblockly code translated to JavaScript on the right side of the browser

Instructional Concepts and Definitions

- Pseudocode - description of the instructions you want to code for a computer program, essentially an outline of the algorithm
- Source code - human-readable instructions for the computer which are translated into machine code by a compiler or interpreter (our source code is written in Ozoblockly here)
- Machine code - binary code instructions the computer can understand
- Binary - a number system with only two numbers: 0 and 1
- Boolean - a type of variable that is either true or false
- Conditional Statements (aka if statements) - a statement defining what condition must be satisfied for a specific action to be done
- For loop - allows instructions to be repeated multiple times (our for loop iterates the same conditional statements for 100 times)
- Variable - the way you store and retrieve information (our variable is color)