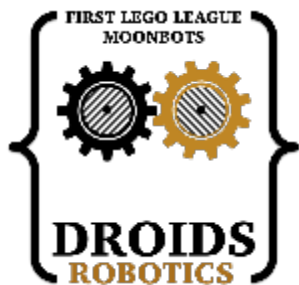


# ADVANCED EV3 PROGRAMMING LESSON

## Arrays



By Droids Robotics



# Lesson Objectives

1. Build upon skills from the Variables lesson in Intermediate
2. Learn how to read/write to arrays
3. Learn about the Array Operations block
4. Learn to use the loop count in a loop

Prerequisites: Data Wires, Loops, Variables

# Why Use Arrays?

1. Simplify programs by storing multiple related values in a single variable
2. Can be used with loops to make compact and useful programs
3. Are useful for making a custom calibration program (see NXT Light Sensor in EV3 on our contributed lessons tab)

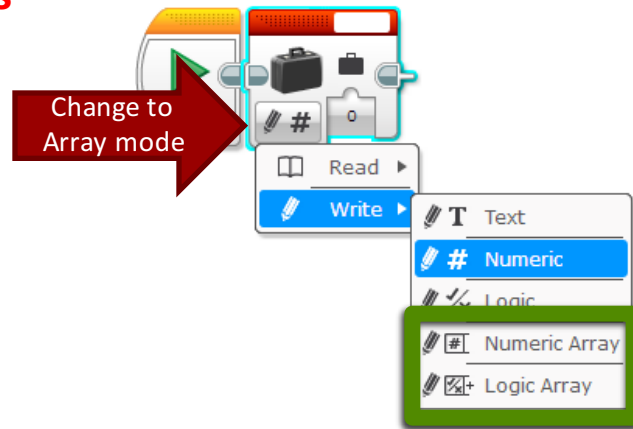
# Arrays



- What is an array?
  - An array is a variable that holds multiple values
- There are two types of arrays:
  - Numeric Array (Holds a set of numbers ... 1,2,3,10,55)
  - Logic Array (Holds a set of logic ... True, True, False)
- They can be used as either Inputs or Outputs so you can either....
  - Write – put a value(s) into the array
  - Read – get the value(s) from the array out

# Array Blocks: Quick Guide

## Modes



Logic Array



Numeric Array



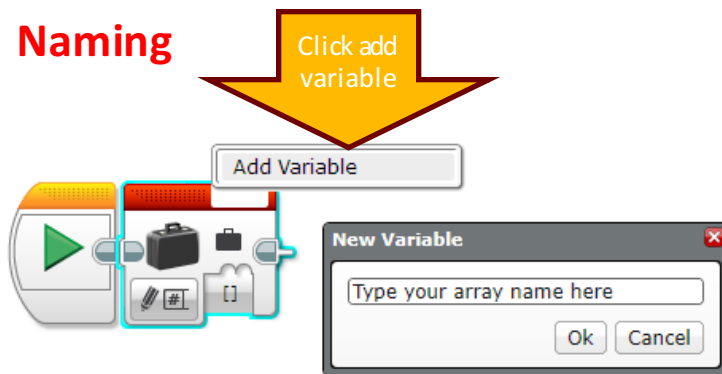
Key

Write (Inputs) have 2 bumps up



Read (Outputs) have 2 bumps down

## Naming



Quiz

Read  
logic  
array

Write  
logic  
array

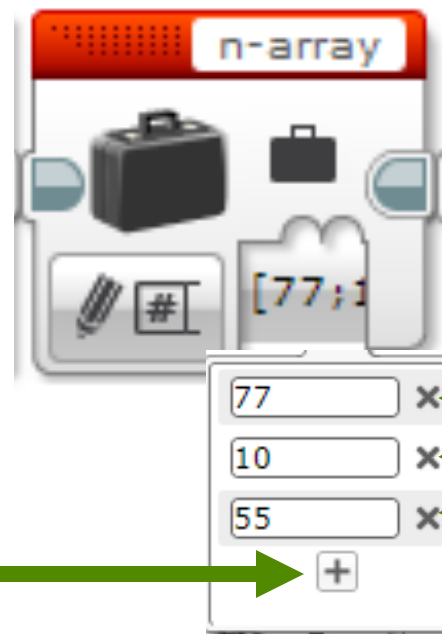
Read  
numeric  
array

Write  
numeric  
array

Identify if the variables are Inputs/Outputs and if they are Numeric/ Logic

# Array Indexes

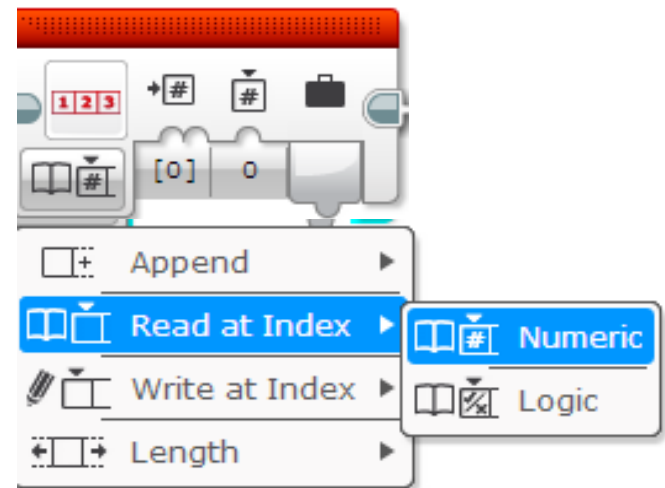
- Each value in an array is assigned an index
- The first value would be at index 0
- Logic arrays would store True/False instead of numbers
- To add a value to an array click the plus +
  - This adds an entry at the next index value (i.e. index 3)



These are values for index 0,1,2

# Block: Array Operations

- This block is used to read or write to Logic or Numeric arrays
- Different modes:
  - Append: Add a new entry after the last array index
  - Read at index: Reads the value at a certain index
  - Write at Index: Write a new value to a certain array index
  - Length: How many entries are in the array
- Both write and append output an array → you will need to write this array back to the variable if you wish to update the stored array (see write/append slides)



# How do you use Arrays (Reading)?

The image shows two Scratch code snippets illustrating how to read an array. The top snippet uses the 'n-array' block, and the bottom snippet uses the 'Log...' block.

**Top Snippet:** A Scratch code block starting with a green flag icon, followed by two 'n-array' blocks. The first 'n-array' block has a list of numbers [77, 10, 55]. The second 'n-array' block has a list of numbers [1, 2, 3]. These are connected to a 'read at index' block with the index set to 1. The output of this block is connected to a 'say' block with the text '0' and a duration of 3 seconds.

**Bottom Snippet:** A Scratch code block starting with a green flag icon, followed by two 'Log...' blocks. The first 'Log...' block has a list of numbers [1, 0, 5]. The second 'Log...' block has a list of numbers [1, 2, 3]. These are connected to a 'read at index' block with the index set to 1. The output of this block is connected to a 'say' block with the text '4' and a duration of 1 second.

**Annotations:**

- Array operation block:** A red box pointing to the 'n-array' blocks in the top snippet.
- Display the value on the screen:** A red box pointing to the 'say' block in the top snippet.
- Read index 1 in the arrays:** A red box pointing to the index '1' in the 'read at index' block of both snippets.
- Above code will display 10**  
**Below code will display 0 for false:** A red box pointing to the 'say' blocks in both snippets.
- Use "read at index" mode:** A blue arrow pointing to the 'read at index' block in the bottom snippet.



# How do you use Arrays (Writing)?

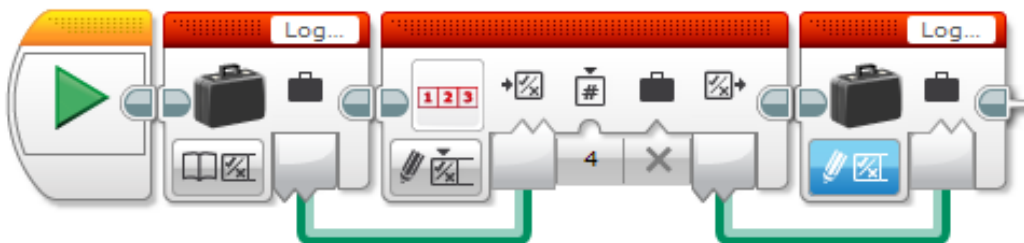


This will write 700 to array at index 4

Read the array you want to write to

Use array operations to write a value to a certain index

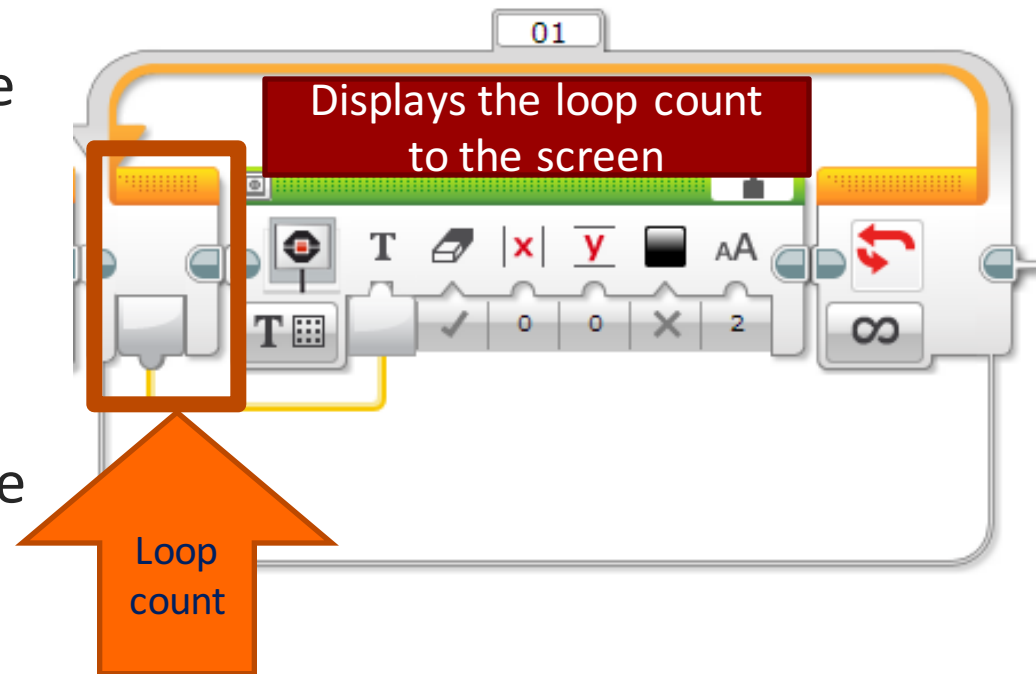
Write the output back to the array



This will write False to array at index 4

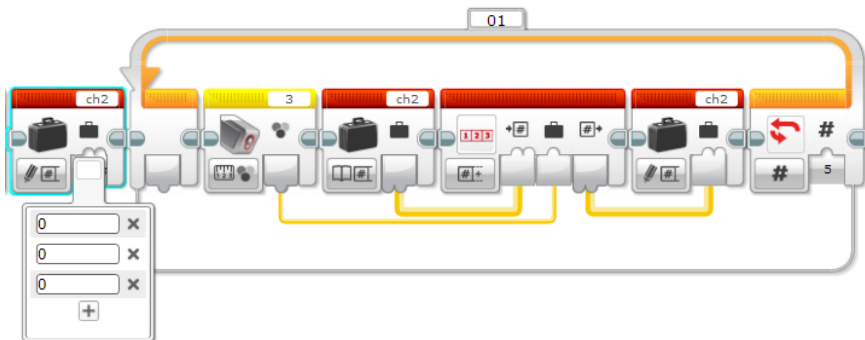
# Block Setting: Loop Count

- The loop count outputs the amount of times the blocks inside the loop have played.
- This is useful to create a program that runs different code every time it goes in the loop
- It is also useful for computing on each item of an array



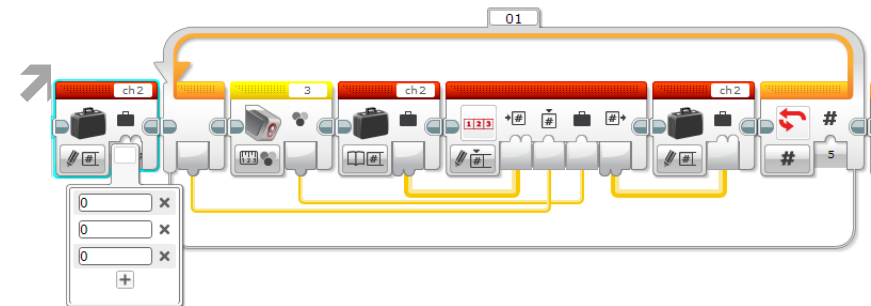
# Note: Append vs. Write

- Append adds entries to the end of an array (i.e. creates a new index value)



- This code produces an array with 8 entries (three 0's followed by 5 light readings)

- Write overwrites the entry at the chosen index

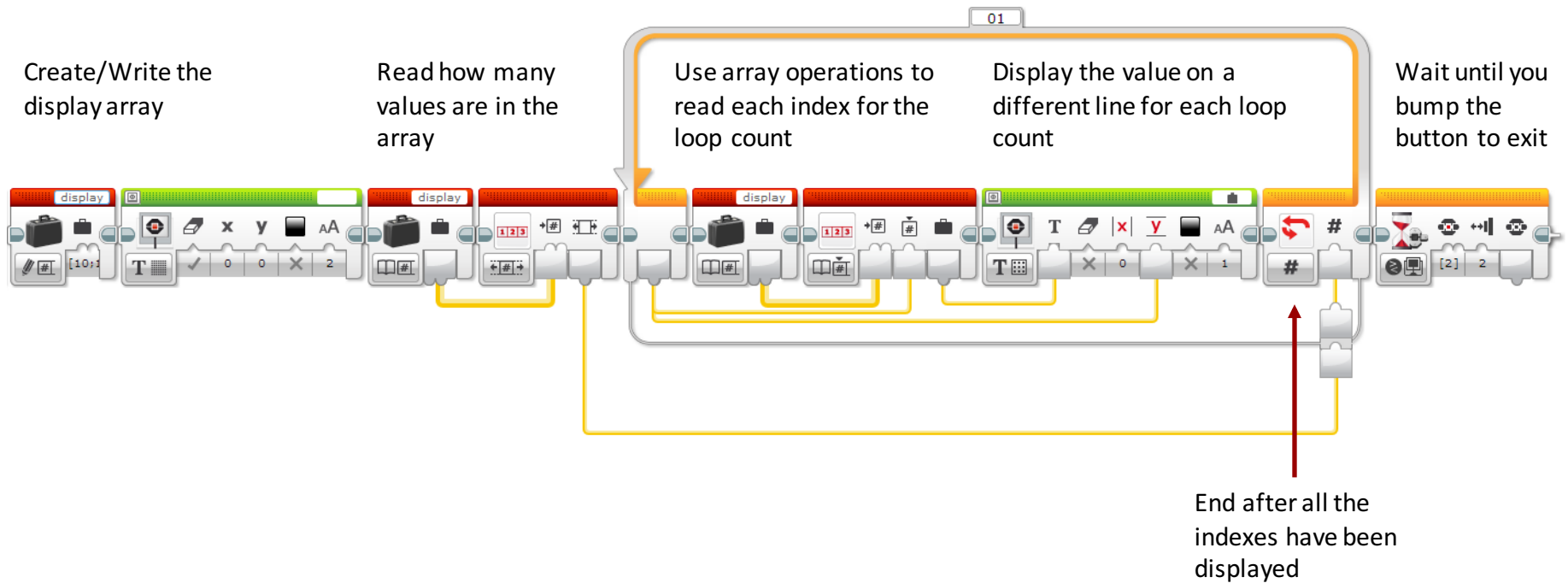


- This code produces an array with 5 entries (just 5 light readings)

# Challenge 1

- Make a program that displays all the entries of an array. Display each index on a different line. You can use only one display block.
- Tips: You will need to use loops, loop count, array block, array operations

# Challenge 1 solution



# Challenge 2

- Make a program that adds up all the entries of an array. Display the sum.
- Tips: You will need to use loops, loop count, array block, array operations



# Next Steps

- Here are some fun things to try:
1. Make a program to compute the average value in an array
  2. Make a program that always saves the last 4 light sensor readings in an array
  3. Create an array that stores calibration values for each sensor port



# Credits

- This tutorial was written by Sanjay Seshan and Arvind Seshan from Droids Robotics
- More lessons at [www.ev3lessons.com](http://www.ev3lessons.com)



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