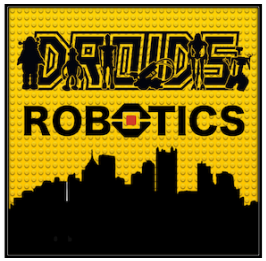
ADVANCED EV3 PROGRAMMING LESSON

Arrays



By Droids Robotics

Lesson Objectives

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

- Prerequisites: Data Wires, Loops, Variables

Why Use Arrays?

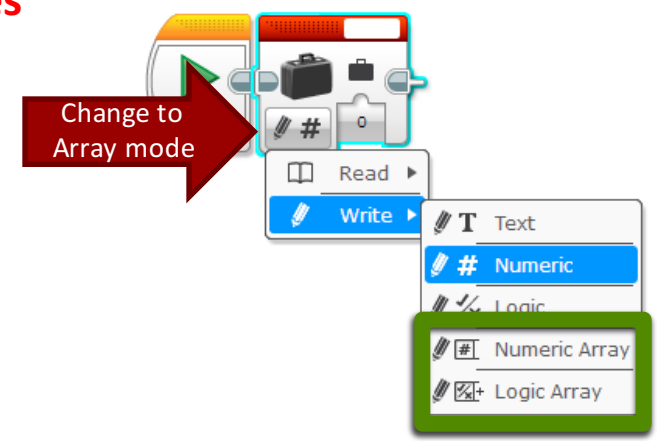
1. Simplify programs by storing multiple related values in a single variable
2. Can be used with loops to make compact and useful programs
3. Are useful for making a custom calibration program (see NXT Light Sensor in EV3 on our contributed lessons tab)

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



Key

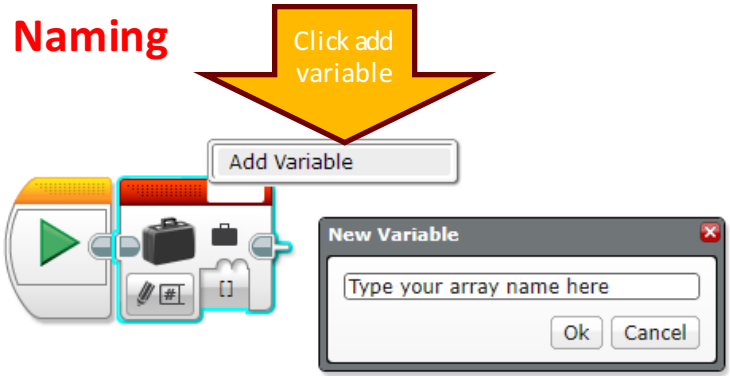
Logic Array

Numeric Array

Write (Inputs) have 2 bumps up

Read (Outputs) have 2 bumps down

Naming



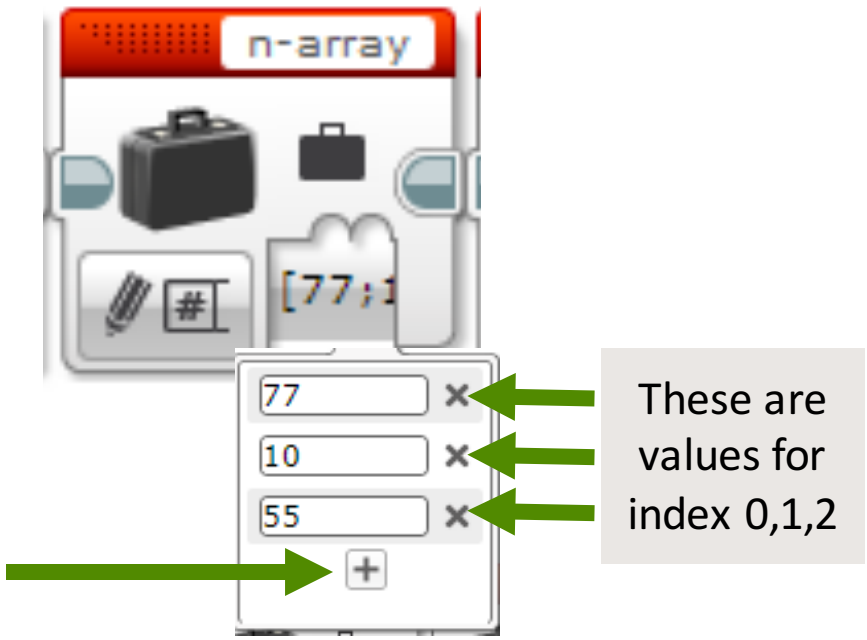
Quiz

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

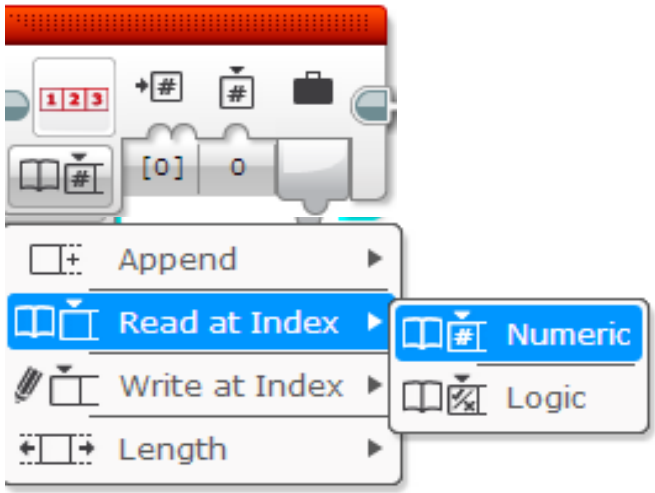
Array Indexes

- 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)

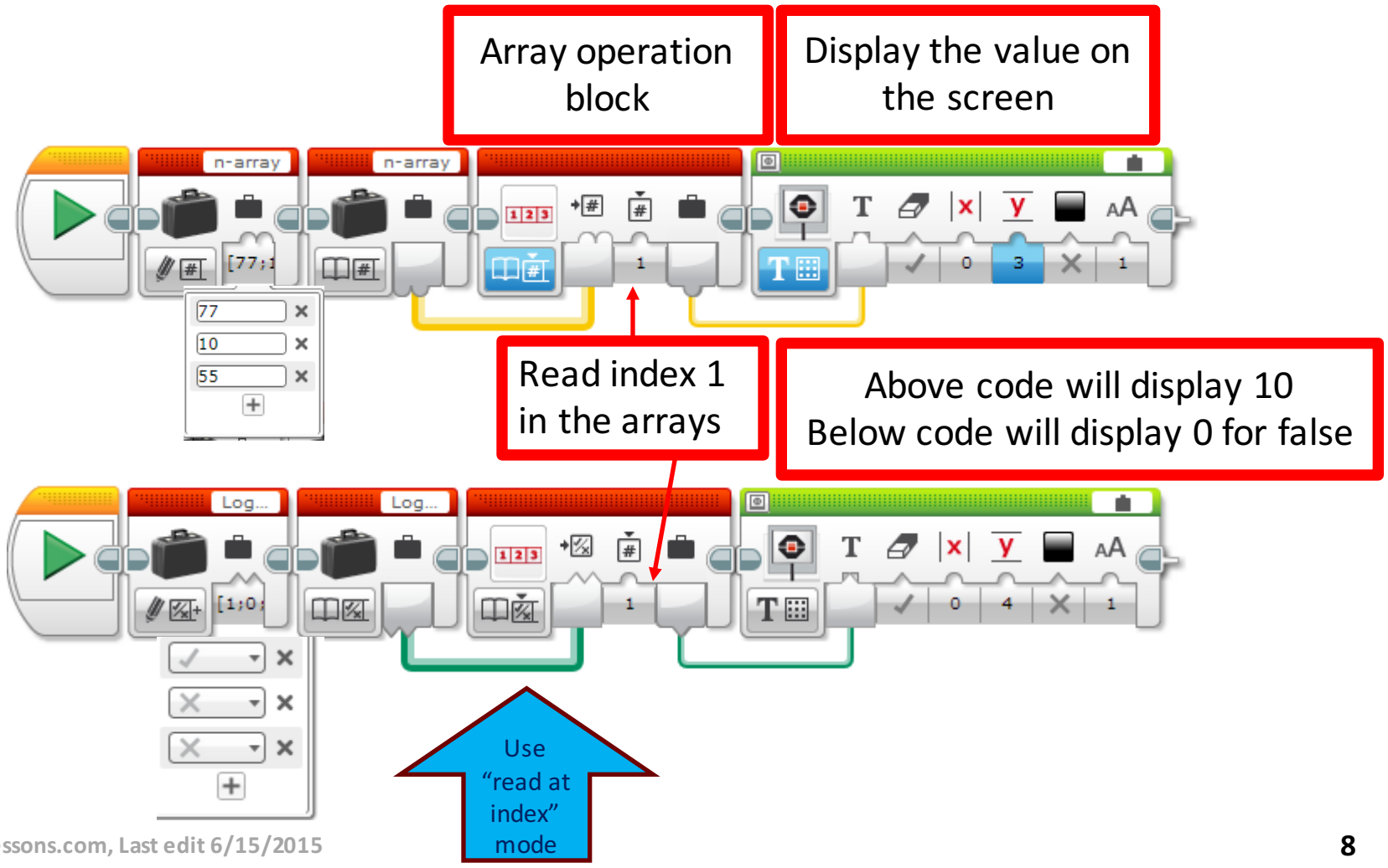


Block: Array Operations

- 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)?



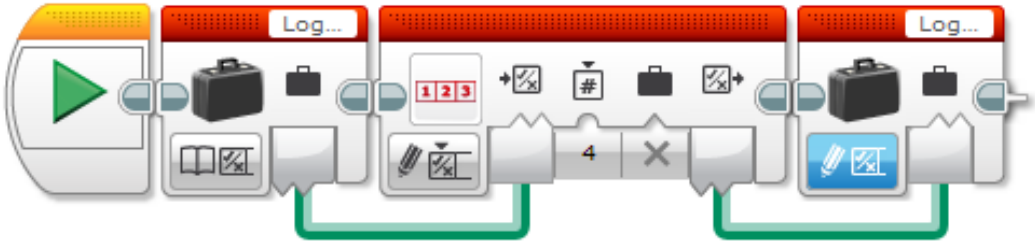
How do you use Arrays (Writing)?

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

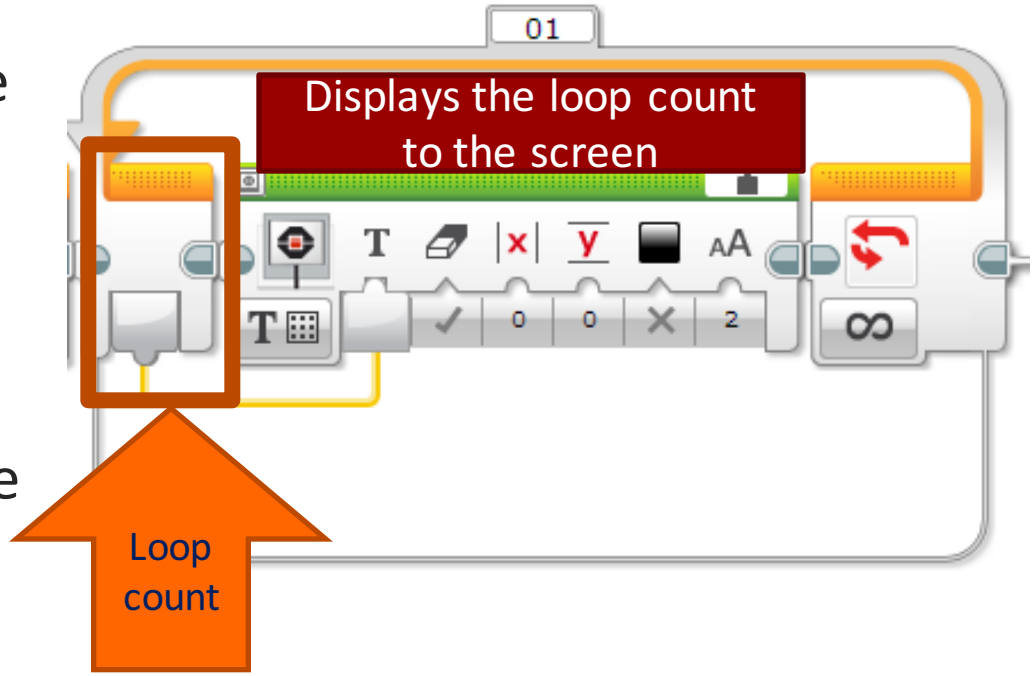
Write the output back to the array



This will write False to array at index 4

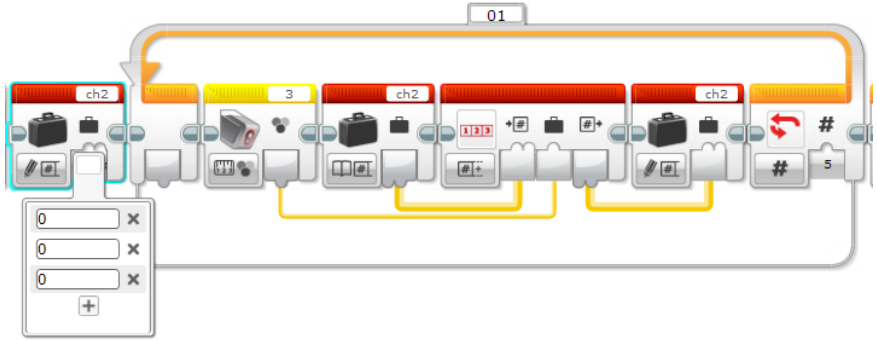
Block Setting: Loop Count

- 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



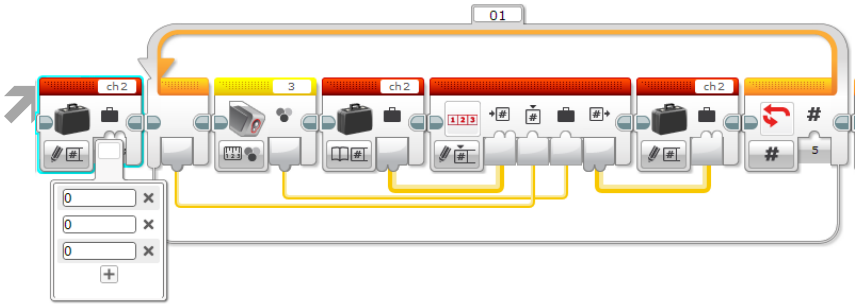
Note: Append vs. Write

- 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

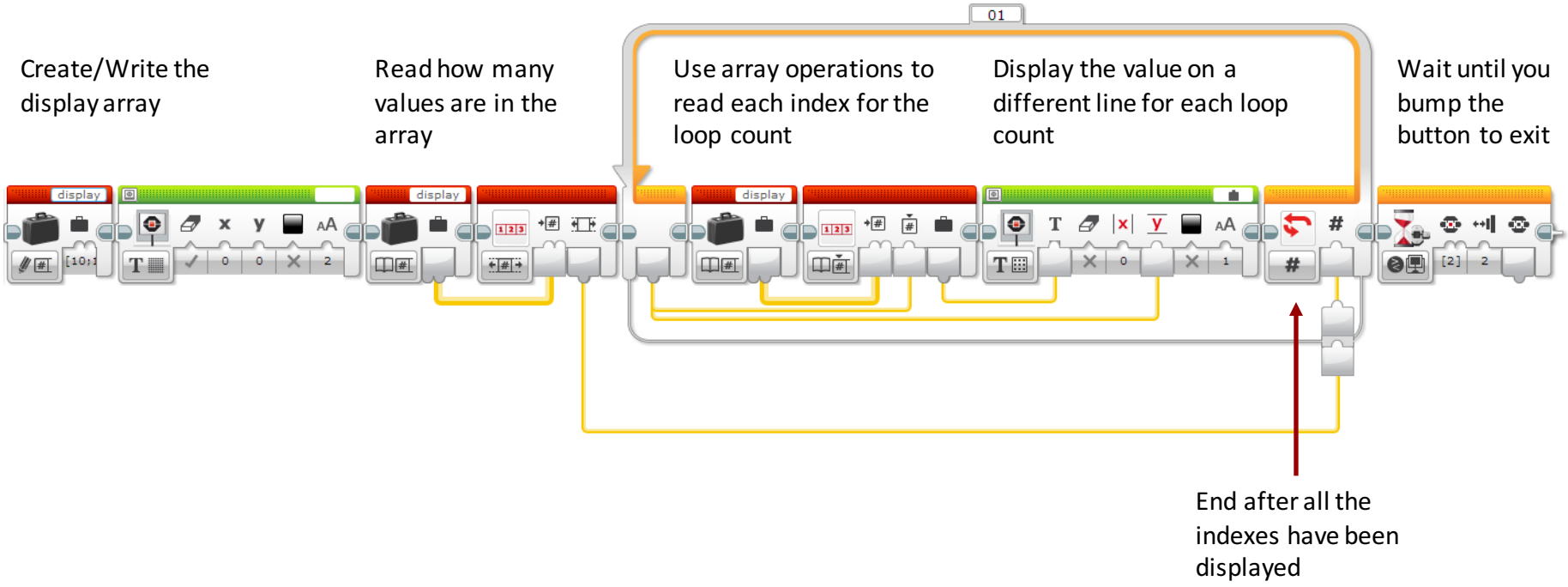


- This code produces an array with 5 entries (just 5 light readings)

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

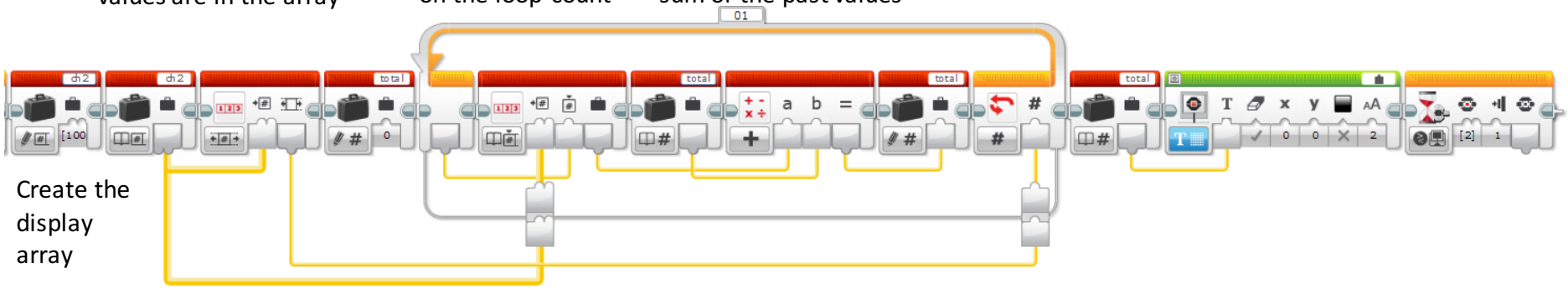
Challenge 2 Solution

Read how many values are in the array

Read the index based on the loop count

Add the array value to the sum of the past values

Display to the screen



Create the display array

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