LEVEL A: SCOPE AND SEQUENCE

LESSON 1

Introduction to Components: Batteries and Breadboards

- What is Electricity?
  - Static Electricity vs. Current Electricity
  - Voltage, Current, and Resistance
- What is a Circuit?
  - Short Circuits
  - Open Circuits vs. Complete Circuits
- Circuit Components
  - Batteries
    - Anode vs. Cathode
  - Breadboards
    - Soldered Circuits vs. Breadboard Circuits
    - Breadboard Connections and Power
- Activity: Powering Breadboard Connections

LESSON 2

Introduction to Components: Resistors and LED

- Resistors
  - How Resistors Work
  - Using Resistors to Build Circuits
  - Calculating Resistance Value
- Light Emitting Diode
  - How LEDs Work
  - LED Polarity
  - Pairing Resistors and LEDs
- Calculating Forward Voltage
- Activities
  - Activity #1: Build a Circuit to Illuminate an LED
  - Activity #2: Build a Series Circuit

LESSON 3

Series vs. Parallel Circuits and Ohm's Law

- Series vs. Parallel Circuits
  - Limitations to Series Circuits
  - Resistor Use in Parallel Circuits
  - Understanding Voltage, Resistance, and Current in Serial vs. Parallel Circuits
- Ohm's Law
  - Introduction to Ohm's Law
  - Mathematical Formula
  - Ohm's Law Calculation Example
- Activities: Build a Parallel Circuit

LESSON 4

Introduction to Components: Jumper Wires

- Jumper Wire
  - Uses for Jumper Wire
  - Size and Type of Jumper Wire
  - Spacing Components to Avoid Short Circuits
- Activity: Build a Circuit Using Jumper Wires

LESSON 5

Introduction to Components: Switches

- Switches
  - Common Uses for Switches
  - Types of Switches
    - Maintained vs. Momentary
    - Normally Open vs. Normally Closed
  - Poles and Throws
- Labeling Components
- Activities
  - Activity #1: Controlling Two LEDs with One Switch
  - Activity #2: Using Two Switches to Independently Control LEDs

LESSON 6

Introduction to Components: Red-Blue-Green LED (RGB LED)

- RGB LEDs
  - Common Anode vs. Common Cathode
  - Proper Placement in Breadboard
- Activities
  - Activity #1: Illuminate the Red Element of the RGB LED
  - Activity #2: Add the Blue Element on a Switch
  - Activity #3: Controlling Colors on a Switch

LESSON 7

Troubleshooting Circuits

- Introduction to Troubleshooting
- Troubleshooting Steps:
  - Verify There is a Failure
  - Check the Simplest or Most Likely Solution First and Retest
  - Half-Splitting
  - Repair the Problem and Retest
- Practical Applications
  - Intermittent Problems
  - Equipment Failure
- Activities
  - Activity #1: Building and Troubleshooting a Circuit
  - Activity #2: Additional Troubleshooting Practice

LESSON 8

Introduction to Reading Schematics

- Schematics
  - Reading Schematics
  - Common Schematic Symbols
    - Wires
    - Power
    - Switches
    - Resistors
    - Diodes
    - Capacitors
    - Transistors
    - Integrated Circuits
    - Header
- Activities
  - Activity #1: Building a Series Circuit Using a Schematic
  - Activity #2: Building a Parallel Circuit Using a Schematic
  - Activity #3: Working with a Schematic

LESSON 9

Setting Up the Raspberry Pi

- Raspberry Pi Hardware
- Raspberry Pi Software
    - Types of Software
        - Raspian OS
        - Python
        - Nano
        - Thonny
    - Types of Interface
        - GUI
        - Terminal
- Optional Lesson: Understanding Sudo and Update Commands
    - APT-GET Update
    - APT-GET DIST-UPGRADE
- Activities
    - Activity #1: Installing the Raspberry Pi in a Protective Case
    - Activity #2: Connecting Peripherals to the Raspberry Pi
    - Activity #3: Safely Powering the Raspberry Pi On and Off
    - Activity #4: Connecting the Raspberry Pi to the Internet
    - Activity #5: Updating the Raspberry Pi's Software

LESSON 10

Introduction to Software: Terminal and Thonny

- Nano Overview
- Thonny Overview
- Error Checking Options
- Activities
    - Activity #1: Creating a Python Program in Nano
    - Activity #2: Creating a Python Program in Thonny
    - Activity #3: Exploring Thonny's Error Checking Features

LESSON 11

Creating Python Programs

- Program Flow
- Strings
- Variables
    - Spaces and Capitalization
    - Integers
    - Equations
- Print Command
    - Printing a String
    - Printing a Variable
- Order
- Activities
    - Activity #1: Reading and Writing Basic Python Code
    - Activity #2: Writing Basic Python Code

LESSON 12

Code Organization, User Input, and Merging Strings

- Keeping Code Organized
    - Carriage Returns
    - Comments
        - Formatting Comments
        - Commenting Out Code
- User Input
- Merging Strings (Concatenation)
- Activities
    - Activity #1: Reading and Writing Python Code
    - Activity #2: Writing a Simple Program in Python

LESSON 13

Math Functions, Lists, and Importing Modules

- Math Functions
- Lists
    - Formatting Lists
    - Index Values
- Importing and Using Modules
    - Time Module
    - Random Module
- Activities
    - Activity #1: Exponential Math Calculations
    - Activity #2: Importing the Random Module
    - Activity #3: Random Dice Program
    - Activity #4: Importing the Time Module
    - Activity #5: Times Up! Game

LESSON 14

Introducing If/Else Statements

- Boolean Logic
    - Coding Comparison Operators
    - Connecting Multiple Logic Expressions
- Programming for Decisions
    - If Statements
    - Else Statements
    - Using Multiple Statements Inside an If Statement
    - Elif Statements
    - Formatting Concerns
- Activities
    - Activity #1: Using Boolean Logic
    - Activity #2: Deciphering Code
    - Activity #3: Writing Logical Code

LESSON 15

Nested If Statements and String/Integer Conversion

- Nested If Statements
  - Indentation
- Strings vs. Integers
  - Converting a Value to an Integer
  - Converting a Value to a String
- Activities
  - Activity #1: Add Five Years to Your Age
  - Activity #2: Age Calculator
  - Activity #3: Guess A Number

LESSON 16

Controlling a Breadboard Circuit with the Raspberry Pi

- General Purpose Input Output (GPIO)
  - Pin States: Low vs. High
  - Outputs
- GPIO Header
  - GPIO Pin Numbering
  - GPIO Header Pin Assignments
- Python Commands and Process for Working with GPIO Pins
  - Importing Module
  - Specifying Pins
  - Cleanup Operations
- Activities
  - Activity #1: Preparing the Equipment for Connection
  - Activity #2: Powering an LED Using the Raspberry Pi

LESSON 17

Loops

- Introduction to Loops
  - Coding Loops
- Activities
  - Activity #1: Build a 4 LED Circuit
  - Activity #2: Create a Program to Test Circuit Functionality
  - Activity #3: Using Loops to Control LEDs

LESSON 18

Final Project: Two Player Reaction Game

- Inputs
  - Electrical Differences in Configurations
- Another Random Module Command
- Other Uses for the Time Module
- Trimming a Long Number
- While Loops
- Activities
  - Activity #1: Add Switches to the Circuit
  - Activity #2: Coding the Two Player Game