Frog Microcontroller Trainer (FMT): Tone Functions
Length of Time: 1 x 55 Minutes
*Recommended for Intermediate*

Overview:

- In this project students will learn about the benefits of using a library to save development time and frustration.

Objectives:

Students will be able to:

- Access the built-in library of code embedded in the Arduino IDE platform
- Use the piezo speaker to generate a tone when pressing SW1 using the library of code
- Explore other library options that can be used with the FMT
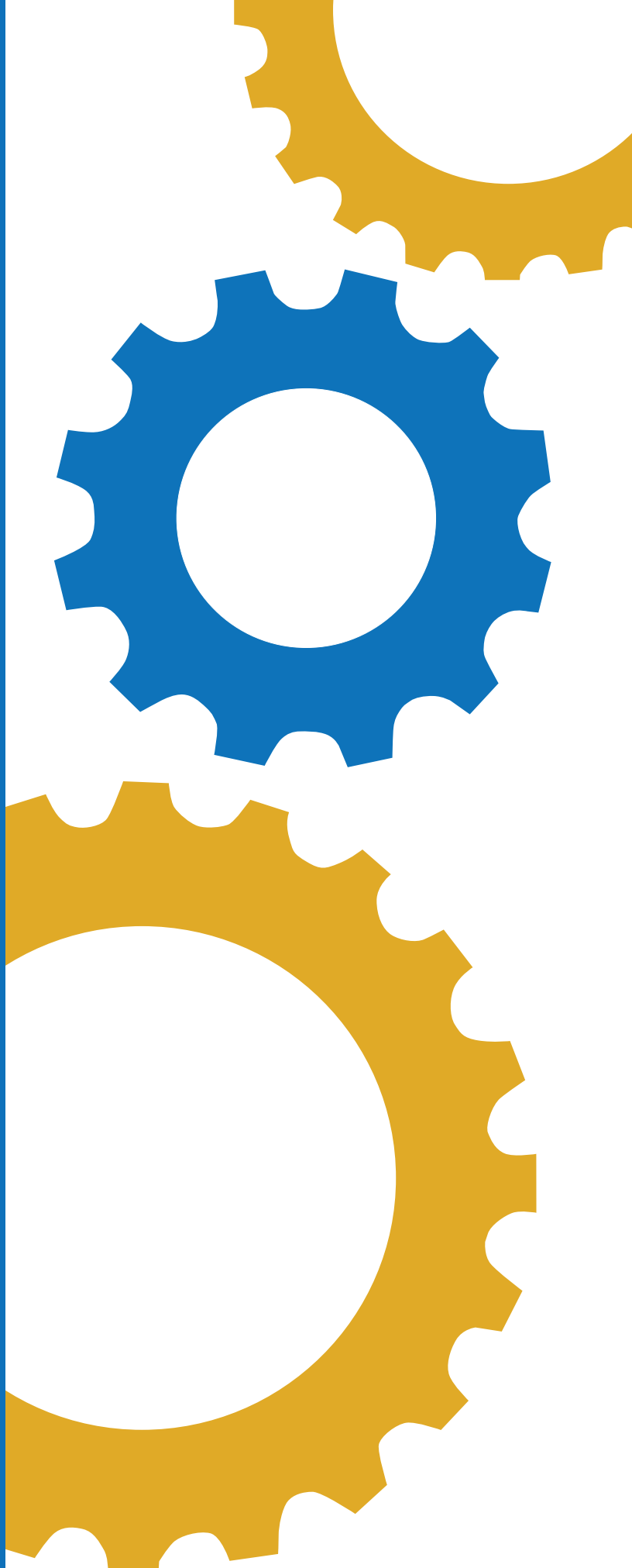
Indiana standards for Principles of Computing:
- 7183.D2.2- Apply basic logical structures, file handling, matrices, and arrays to program algorithms.

CSTA:
- 1A-CS-02 Use appropriate terminology in identifying and describing the function of common physical components of computer systems.
- 1B-AP-12 Modify, remix or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.
- 2-AP-16 Incorporate existing code, media, and libraries into original programs, and give attribution.

Materials:
- [Frog Microcontroller Trainer](#) from 1st Maker Space
- USB Power Cord
- Arduino IDE
- PC or Mac
- Chromebooks if using Arduino Create for Education App
- Introduction to Microcontroller Trainer Lesson (if needed as a resource)

Preparation:
- Ensure students have a compatible device and have downloaded the Arduino IDE software on device.
- Ensure all students know how to properly connect the FMT to the device via the USB cable.

Background Information:
A library is a set of pre-made functions written by yourself or other people. Adding them into your program will provide additional functionality and cut down on development time significantly.

Lesson Elements			
Introduction to Library in Arduino IDE– 10 minutes	The library we use in the example is the "tone" library. This library is automatically included in Arduino. All we have to do to use it is call the **tone** function. See the table below for parameters:		

Function Name	Parameter 1	Parameter 2	Parameter 3
tone	Pin number that the piezo is connected to	Desired frequency	Tone duration

Access 1MS Code –	Visit the 1st Maker Space [website](#) and access the library of code developed specifically for the FMT. Here, you will find a section with

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10 minutes	various code (called projects) written for each major component of the trainer. The teacher will locate the sketch by clicking on 4.04- There is a Library for That
	Project 4.04 There is a library for that In this project, you'll simplify the process of generating tones with a Piezo buzzer by using the built-in "tone()" function of the Arduino library! Read More →
	Here, one can find the sketch to share with students. Students can simply copy the code by selecting the blue copy button.
	Project 4.04 There is a library for that In this project we will learn about the benefits of using a library to save development time and frustration. **Project Code:** ```\n///\n// 4.04 - There is a library for that\n\nbyte piezoPin = 12;\n\nbyte SW1 = 1;\nbool pressed = LOW;\n\nvoid setup() {\n pinMode(piezoPin, OUTPUT);\n pinMode(SW1, INPUT);\n\n}\n\nvoid loop() {\n if (digitalRead(SW1) == pressed) {\n tone(piezoPin, 500, 100);\n }\n}\n///\n```
Connect the Trainer and Verify the Sketch– 10 minutes	Plug the Frog Microcontroller Trainer into your computer's USB port. Using the dropdown box near the top, select the Arduino Leonardo and appropriate COM port. **Note:** Mac computers may automatically select the port.
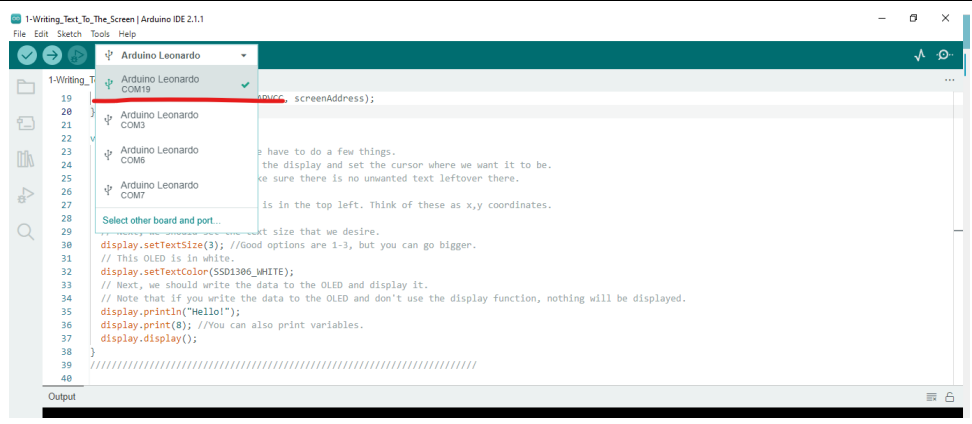
Making sure the USB cable is connecting the FMT to the computer, verify the sketch by clicking on the check mark in the upper left-hand corner.

Once verified, upload the sketch to the trainer by clicking the right-facing arrow. It will turn yellow.

	To understand if the sketch is working correctly, the piezo speaker will release a tone when SW1 is pressed.
Arduino Libraries and Common Problems – 15 Minutes	Once students have successfully run the sketch, have them brainstorm a list of common problems that it might be beneficial to have a library of code for. Encourage them to use the components on the FMT to consider what common problems they might encounter.

Career Exploration:
- A good resource is the IDOE Career Explorer database.
- Another good resource for career information is the Bureau of Labor Statistics

Practical Application:
A programming library is a collection of prewritten code that programmers can use to optimize tasks. This collection of reusable code is usually targeted for specific common problems. A library usually includes a few different pre-coded components.

What's Next?:
- FMT: Project 4.04- Tone Functions

Additional Resources:
- 1st Maker Space Frog Microcontroller Library
- 1st Maker Space Learn Arduino with the Frog Microcontroller

Performance Assessment/Check for Understanding:
- Was the student able to successfully load the sketch to the FMT and the piezo speaker generate a tone?
- Did the student compile a list of common problems that it would be beneficial to have a library of code for?