FIRIA LABS

Python with Robots Mission Pack

Middle School Curriculum Guide

Building with Code:

An introduction to Python coding

Unit 1: Introduction to Python with Robots (4-10 hours)

Students will learn about the programming environment, the CodeBot, and basic commands for programming the CodeBot using Python. Students create their own program to move the 'bot in a simple shape, like a square and use button presses for input.

Summary of Getting Started:

> Students create an account and join the class to access the curriculum.

Summary of Mission 1:

> Students become familiar with CodeSpace by learning its parts and features. It ends with an activity to label the parts of CodeSpace.

Summary of Mission 2: This mission is divided into two lessons, each approximately one class period.

> **Lesson 1:** Students learn about CodeBot, its peripherals, and proper care.

> **Lesson 2:** Students create a simple program by importing a library (module) and turning on an LED.

Summary of Mission 3: This mission is divided into four lessons, each approximately one class period. Students follow along with the slides and instructions in CodeSpace for the first lesson. The last lessons add to and change up some instructions in CodeSpace, and the slides can be used instead of the instructions in CodeSpace but still cover the same material.

> **Lesson 1:** Students learn about the LEDs and turning them on and off. There are two sets of LEDs on the'bot that can be controlled. Students also learn about variables and the debugger.

> **Lesson 2:** Binary is introduced and how to use it in code to turn on/off LEDS.

> **Lesson 3:** Students learn how to turn on the motors and move the wheels both forwards and backwards and rotationally. Two robot labs are added in the assignment.

> **Lesson 4:** Students learn about algorithms and putting together several steps to complete a task. They learn about push buttons and if statements to add decisions to code.

Unit 1 Remix: The remix project can be an extension of a current program or a completely new project. Students can work individually with a partner, or in teams.

Unit 1 Classroom Materials that are provided for each lesson:

- **Lesson Plan:** A detailed lesson plan is provided for each lesson. It includes learning targets, success criteria, vocabulary and new code. It also has teaching tips for each objective.
- **Mission Slidedeck:** Each lesson includes PowerPoint slides for teacher-led instructions. You can use them to guide students through the material. It is a supplement and alternative to reading a lot of instructions in CodeSpace. The slides mirror the instructions, with simplified language that is chunked into smaller sections at a time. The slides also provide added information, examples and instructions.
- **Mission Log:** Each lesson has an assignment, called a mission log, for students to complete as they go through the lesson. It includes warm-up and wrap-up questions as well as questions along the way for guided notes. An answer key for each mission log is provided.
- **Kahoot! Review:** Each lesson has a Kahoot! that reviews the concepts and codes.

Unit 1 Preparation:

- Create a class on the teacher dashboard.
- Have a computer / laptop with the Chrome web browser for each student.
- Make sure students can log in and create an account at http://make.firialabs.com, They will need an email address.
- Be able to give students the class join code.
- Have a CodeBot and USB cable for each student or programming pair.
- Have a ruler for measuring the distance traveled by the 'bot.
- Have a protractor for measuring angles (one is provided that can be printed).

Assessment:

Mission 1 Kahoot Review	Mission 2 Obj 1-5 Kahoot	Mission 2 Obj 6-10 Kahoot	Mission 3 Obj 1-5 Kahoot
Mission 3 Obj 6 Kahoot	Mission 3 Obj 7-8 Kahoot	Mission 3 Obj 9-11 Kahoot	

Coming soon: Unit 1 reviews and multiple choice exams are provided. They are divided into two parts: vocabulary and coding. The reviews are available as Kahoots, and the exams are provided as MS Forms.

All review and test questions are provided in the Unit 1 Review and Test Questions document.

Unit 1 Vocab Kahoot Review	Unit 1 Coding Kahoot Review	Unit 1 Vocab Test (MS Form)	Unit 1 Coding Test (MS Form)

Standards addressed in this unit:

CSTA Standards Grades 6-8	CSTA Standards Grades 9-10	CSTA Standards Grades 11-12
2-CS-03 2-DA-07 2-AP-10 2-AP-11 2-AP-12 2-AP-13 2-AP-15 2-AP-16 2-AP-18 2-AP-19	3A-CS-03 3A-DA-09 3A-AP-13 3A-AP-16 3A-AP-19 3A-AP-21 3A-IC-26	3B-AP-10 3B-AP-16 3B-AP-17 3B-AP-22

A guide for this unit can be found in the Learning Portal. Each unit includes: complete lesson plans, new Python code, unit vocabulary, mission log assignments, answer keys, review questions and code solutions.

Unit 2: Animatronics Robot Application (6-10 hours)

Students continue their programming journey by combining LED lights, movement and sound. They learn about loops and defining and calling functions. Students create three individual programs that accomplish a single task, and then combine them into one program for an animatronics robot application.

Summary of Mission 4: This mission is divided into four lessons, each approximately one class period. During the mission students are given the assignment to create an animatronic robot exhibit for a major theme park, with a sketch of the algorithm on a napkin. The tasks are divided into three lessons.

> **Lesson 1:** The first requirement for the animatronics exhibit is to flash the user lights in a cool pattern. Students use an infinite loop and a variable for the LED.

> **Lesson 2:** The second requirement is to count the guests. Students define and update a counter variable and learn about incrementing. They learn how to break out of a loop, and use basic speaker functions.

> **Lesson 3:** The remaining requirements are to move the CodeBot and play a fanfare. Students learn about a loop that repeats a specified number of times, and use random numbers to generate robot beeps. They define and call a function.

> **Lesson 4:** Students complete the fanfare music and then put together the three separate programs into one complete animation project.

Unit 2 Remix: Unit 2 is only four lessons from Mission 4. This is an excellent opportunity for a group project, meeting the CSTA standards for collaboration and working in teams. The project can be another animatronics program, but one that does something different than Mission 4.

> **Recommendation:** Since the lessons in this unit all involve separate programs that are then combined into one complete project, your students can devise a project similar to the animatronics project that has multiple tasks. Each student can create their own program that accomplishes one or two tasks. Then the group can combine the parts into a complete project. You can assign team roles and use multiple forms of communication and task tracking. Students can get feedback from multiple users and in various ways and then refine their project. You can emphasize accessibility and equity with the feedback and refinements.

Unit 2 Classroom Materials that are provided with each lesson:

- **Lesson Plan:** A detailed lesson plan is provided for each lesson. It includes learning targets, success criteria, vocabulary and new code. It also has teaching tips for each objective.
- **Mission Slidedeck:** Each lesson includes PowerPoint slides for teacher-led instructions. You can use them to guide students through the material. In this unit, the slides should be used instead of the instructions in CodeSpace and CodeTrek. They introduce things a little differently. All goals will be met, but the code in the slides looks a little different than the code in CodeTrek.
- **Mission Log:** Each lesson has an assignment, called a mission log, for students to complete as they go through the lesson. It includes warm-up and wrap-up questions as well as questions along the way for guided notes. An answer key for each mission log is provided.
- **Kahoot! Review:** Each lesson has a Kahoot! that reviews the concepts and codes.

Unit 2 Preparation:

- Have a computer / laptop with the Chrome web browser for each student.
- Make sure students can log into CodeSpace at http://make.firialabs.com with their email address.
- Have a CodeBot and USB cable for each student or programming pair.
- Have a ruler for measuring the distance traveled by the 'bot.

Assessment:

Mission 4 Obj 1-3 Kahoot Review	Mission 4 Obj 4-7 Kahoot Review	Mission 4 Obj 8-11 Kahoot Review
Mission 4 Obj 12 Kahoot Review		

Coming soon: Unit 2 reviews and multiple choice exams are provided. They are divided into two parts: vocabulary and coding. The reviews are available as Kahoots, and the exams are available as MS Forms.

All review and test questions are provided in the Unit 2 Review and Test Questions document.

Unit 2 Vocab Kahoot Review	Unit 2 Coding Kahoot Review	Unit 2 Vocab Test (MS Form)	Unit 2 Coding Test (MS Form)

Standards addressed in this unit:

CSTA Standards Grades 6-8	CSTA Standards Grades 9-10	CSTA Standards Grades 11-12
● 2-CS-01 ● 2-CS-03 ● 2-DA-08 ● 2-DA-09 ● 2-AP-10 ● 2-AP-11 ● 2-AP-12 ● 2-AP-13 ● 2-AP-14 ● 2-AP-15 ● 2-AP-16 ● 2-AP-18 ● 2-AP-19	● 3A-CS-01 ● 3A-CS-03 ● 3A-AP-13 ● 3A-AP-15 ● 3A-AP-16 ● 3A-AP-17 ● 3A-AP-18 ● 3A-AP-19 ● 3A-AP-21 ● 3A-AP-22 ● 3A-AP-23 ● 3A-IC-25 ● 3A-IC-27	● 3B-CS-02 ● 3B-DA-06 ● 3B-AP-10 ● 3B-AP-14 ● 3B-AP-16 ● 3B-AP-17 ● 3B-AP-20 ● 3B-AP-22 ● 3B-AP-23

A guide for this unit can be found in the Learning Portal. Each unit includes: complete lesson plans, new Python code, unit vocabulary, mission log assignments, answer keys, review questions and code solutions.

Unit 3: Line Sensor Data (8-12 hours)

Students expand CodeBot's abilities by utilizing data from the five line sensors mounted on the front of the 'bot. They learn about loops and defining and calling functions. Functions are defined with and without parameters, and also with and without a return. Line sensor data is used to control CodeBot, creating an autonomous robot.

Summary of Mission 5: This mission is divided into four lessons, each approximately one class period. During the mission students learn about line sensors and how to access the data. They also learn about using the console log to display data. The final program is an autonomous robot that moves inside a bounded area.

> **Lesson 1:** Line sensors are introduced. Students learn about analog and digital and why data must be converted. They use the console panel to display a line sensor reading for different surfaces.

> **Lesson 2:** Students define a function that reads a single LED and uses a parameter to determine which line sensor. Another function is defined that uses a loop to call the first function and read all the line sensors. A Boolean variable is used to turn on/off the corresponding LED.

> **Lesson 3:** Students add a "return" statement to each function so it can return a Boolean value that determines if a line was detected. A counter variable is incremented when a line is detected, and the number is displayed using the user LEDs. An if statement is added to reset the counter when it reaches its maximum value. Also, the "wait" safety feature used in Mission 4 is added to the program.

> **Lesson 4:** This lesson is only one objective. Students define functions for moving the robot and add the function calls in the main program. The Kahoot quiz reviews the entire mission.

Summary of Mission 6: This mission is divided into three lessons, each approximately one class period. During the mission students create a line following program using line sensor data for proportional control.

> **Lesson 1:** Students learn about using a list in code, and use line sensor data to turn on/off LEDs.

> **Lesson 2:** Students learn about using a tuple in code, and use the pre-coded ls.check() function to read line sensor data. A simple line follower program is created.

> **Lesson 2:** Tuples are used in conditions for proportional control. Also, students write a function for calibrating CodeBot.

Unit 3 Remix: The remix project can be an extension of a current program or a completely new project. Students can work individually with a partner, or in teams.

Unit 3 Classroom Materials that are provided with each lesson:

- **Lesson Plan:** A detailed lesson plan is provided for each lesson. It includes learning targets, success criteria, vocabulary and new code. It also has teaching tips for each objective.
- **Mission Slidedeck:** Each lesson includes PowerPoint slides for teacher-led instructions. You can use them to guide students through the material. In this unit, there are many times the slides should be used instead of the instructions in CodeSpace and CodeTrek. They introduce things a little differently, and often give more examples. All goals will be met, but the code in the slides looks a little different than the code in CodeTrek.
  Mission Log: Each lesson has an assignment, called a mission log, for students to complete as they go through the lesson. It includes warm-up and wrap-up questions as well as questions along the way for guided notes. An answer key for each mission log is provided.
- **Kahoot! Review:** Each lesson has a Kahoot! that reviews the concepts and codes.

Unit 3 Preparation:

- Have a computer / laptop with the Chrome web browser for each student.
- Make sure students can log into CodeSpace at http://make.firialabs.com with their email address.
- Have a CodeBot and USB cable for each student or programming pair.
- Four AA batteries are needed for each CodeBot.
- Print the Testing Surfaces paper for each student or programming pair.
- A driving surface is needed. Use white posterboard with black electrical tape.

Assessment:

Mission 5 Obj 1-2 Kahoot	Mission 5 Obj 3-5 Kahoot	Mission 5 Obj 6-8 Kahoot	Mission 5 Kahoot Review
Mission 6 Obj 1-3 Kahoot	Mission 6 Obj 4-6 Kahoot	Mission 6 Obj 7-8 Kahoot	

Coming soon: Unit 3 reviews and multiple choice exams are provided. They are divided into two parts: vocabulary and coding. The reviews are available as Kahoots, and the exams are available as MS Forms. **All review and test questions are provided in the Unit 3 Review and Test Questions document.**

Unit 3 Vocab Kahoot Review	Unit 3 Coding Kahoot Review	Unit 3 Vocab Test (MS Form)	Unit 3 Coding Test (MS Form)

Standards addressed in this unit:

CSTA Standards Grades 6-8	CSTA Standards Grades 9-10	CSTA Standards Grades 11-12
2-CS-01 2-CS-02 2-CS-03 2-DA-08 2-DA-09 2-AP-10 2-AP-11 2-AP-12 2-AP-13 2-AP-14 2-AP-15 2-AP-16 2-AP-17 2-AP-19	3A-CS-03 3A-DA-11 3A-AP-13 3A-AP-14 3A-AP-15 3A-AP-16 3A-AP-17 3A-AP-18 3A-AP-19 3A-AP-21 3A-AP-23	3B-CS-02 3B-DA-06 3B-AP-10 3B-AP-12 3B-AP-14 3B-AP-16 3B-AP-17 3B-AP-21 3B-AP-22 3B-AP-23

A guide for this unit can be found in the Learning Portal. Each unit includes: complete lesson plans, new Python code, unit vocabulary, mission log assignments, answer keys, review questions and code solutions.

Unit 4: Underneath the Hood (8-10 hours)

Students learn about CodeBot's proximity sensors. Sensor data is used to control CodeBot, tracking and chasing an object. Then students learn about internal sensors for checking battery voltage and CPU temperature. They also learn about the accelerometer, what it is and how to use it for detecting movement. Their skill with functions is improved and expanded, including global and local variables.

Summary of Mission 7: This mission is divided into three lessons, each approximately one class period. During the mission students learn about proximity sensors and how to access the data. The final program is an autonomous robot that can auto-calibrate and then track and follow an object.

> **Lesson 1:** Proximity sensors are introduced. Students learn about power and threshold settings and use pre-defined functions to determine the best settings.

> **Lesson 2:** Students write two functions that work together to auto-calibrate the proximity sensors.

> **Lesson 3:** Students add movement to the program by controlling the motors with the proximity sensor data. The lesson deviates from CodeSpace for Obj 11 and gives an alternative that discusses abstraction and has students define and call two more functions for the program.

NOTE: This unit skips Mission 8 Navigation. It is all about wheel encoders. The code in the objectives uses a lot of functions, lists, and complex math, which can be difficult for middle school or beginner students. The recommendation is to skip the mission entirely, or return to the mission after Unit 4 as a bonus.

Summary of Mission 9: This mission is divided into three lessons, each approximately one class period. Students learn about internal system sensors: battery health, temperature and accelerometer.

> **Lesson 1:** Students learn about checking battery health. They write a program that displays how much power is left in batteries.

> **Lesson 2:** Students learn about system temperature. They write a program that can sound an alarm if the temperature is too hot or too cold.

> **Lesson 3:** Students learn about the accelerometer: what it is and how to read it. They write two programs. The first orients CodeBot to always point its nose up. The second is a guard bot that detects motion.

Unit 4 Remix: The remix project can be an extension of a current program or a completely new project. Students can work individually with a partner, or in teams.

Unit 4 Classroom Materials that are provided with each lesson:

- **Lesson Plan:** A detailed lesson plan is provided for each lesson. It includes learning targets, success criteria, vocabulary and new code. It also has teaching tips for each objective.
- **Mission Slidedeck:** Each lesson includes PowerPoint slides for teacher-led instructions. You can use them to guide students through the material. At times the slides introduce things a little differently, and often give more examples. The code can be slightly different than CodeTrek. All goals will be met.
- **Mission Log:** Each lesson has an assignment, called a mission log, for students to complete as they go through the lesson. It includes warm-up and wrap-up questions as well as questions along the way for guided notes. An answer key for each mission log is provided.

- **Code Solutions:** Sample code for each final project, as well as some of the objectives, can be found in the learning portal with the other teacher materials.
- **Kahoot! Review:** Each lesson has a Kahoot! that reviews the concepts and codes.

Unit 4 Preparation:

- Have a computer / laptop with the Chrome web browser for each student.
- Make sure students can log into CodeSpace at http://make.firialabs.com with their email address.
- Have a CodeBot and USB cable for each student or programming pair.
- Ruler for measuring distance of an object from CodeBot (can use the "White Paper with Ruler" in the learning portal).
- Four AA batteries are needed for each CodeBot.
- Objects for CodeBot to detect (folders, toys, small and large objects)
- A sturdy surface for CodeBot to sit on, inclined.

Assessment:

Mission 7 Obj 1-3 Kahoot Review	Mission 7 Obj 4-7 Kahoot Review	Mission 7 Obj 8-11 Kahoot Review
Mission 9 Obj 1-4 Kahoot Review	Mission 9 Obj 5-7 Kahoot Review	Mission 9 Obj 8-12 Kahoot Review

Coming soon: Unit 4 reviews and multiple choice exams are provided.

Unit 4 Vocab Kahoot Review	Unit 4 Coding Kahoot Review	Unit 4 Vocab Test (MS Form)	Unit 4 Coding Test (MS Form)

Standards addressed in this unit:

CSTA Standards Grades 6-8	CSTA Standards Grades 9-10	CSTA Standards Grades 11-12
2-CS-02 2-CS-03 2-DA-07 2-DA-08 2-DA-09 2-AP-10 2-AP-11 2-AP-12 2-AP-13 2-AP-14 2-AP-15 2-AP-16 2-AP-17 2-AP-19	3A-CS-01 3A-CS-03 3A-DA-11 3A-AP-13 3A-AP-14 3A-AP-15 3A-AP-16 3A-AP-17 3A-AP-18 3A-AP-19 3A-AP-21 3A-AP-23	3B-CS-02 3B-DA-06 3B-AP-10 3B-AP-12 3B-AP-14 3B-AP-16 3B-AP-17 3B-AP-21 3B-AP-22 3B-AP-23

A guide for this unit can be found in the Learning Portal. Each unit includes: complete lesson plans, new Python code, unit vocabulary, mission log assignments, answer keys, review questions and code solutions.