**AP CSP CodeX**

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| **MISSION 7 Obj 7-9 Personal Billboard** | | **Time: 45 minutes** |
| **Project Goal:** Students will use images, text and colors in a list to display a mood by pressing a CodeX button.  **Learning Targets**   * I can create a list to make my code more efficient. * I can distinguish between string and image data types. | **Key Concepts**   * In python, the == is used to compare an equality. * You can check the type of a variable, and deal with it accordingly. * The type() function returns the data type of the argument. It can be used in the Console and in a program. | |
| **Assessment Opportunities**   * Mission 7 Obj 8-11 Assignment * Billboard program * Billboard\_functions program | **Success Criteria**   * Mix text messages with a selection of images and color. * Use existing code to create a function. | |
| **AP CSP Framework**  **AAP-1.C** Represent a list or string using a variable.  **AAP-1.D** Develop data abstraction using lists to store multiple elements, and explain how the use of data abstraction manages complexity in program code.  **AAP-2.I** Write nested conditional statements, and determine the result of nested conditional statements.  **AAP-2.N** Write expressions that use list indexing and list procedures.  **Computational Thinking Practice 3.A** Generalize data sources through variables.  **Computational Thinking Practice 3.B** Use abstraction to manage complexity in a program. | **Materials**   * Mission 7 Obj 7-9 Assignment / Answers * AP CSP CodeX Vocabulary List * AP CSP CodeX Python Code List * Unit 2 Review Links and Test Questions * [Mission 7 Kahoot Review](https://create.kahoot.it/share/firia-labs-mission-7/06203065-5a87-41df-8449-e6381da62196) * Solution code   + billboard\_final   + billboard\_functions   + billboard\_functions\_challenge | |
| **Teacher Notes**   * Mission 7 may take a little over a class period, so it is divided up into two lessons. This is the second lesson. * The assignment is best completed digitally. Prepare the assignment for distributing through your LMS. * Objective 7 introduces strings. You can spend some time on what a string is and how to create one. A string is a type of list, and list functions will also work with a string. * Objective 6 introduces the term “data abstraction” which isn’t specifically mentioned in the CodeSpace instructions, but it is a topic covered on the AP exam. You may want to emphasize this. * The code in Objective 8 will cause an error. This should happen! It will be fixed in the next objective. * Objective 9 fixes the type error. Students should click on the term “error” and read about it in the toolbox. It lists several errors that can occur in a Python program. This is all good information for programming in general and the AP exam specifically. * After Obj 9, students will practice programming skills by adding colors in the form of a tuple, creating and calling functions, and programming a kill switch. Use the time you have, but if all additions aren’t included, that is okay. * An additional challenge is given for any students finishing the program and having extra time. It is not required, but a nice feature of programming, and something they can do for the AP Create PT. * If you have time at the end of the lesson, use the [Mission 7 Kahoot Review](https://create.kahoot.it/share/firia-labs-mission-7/06203065-5a87-41df-8449-e6381da62196). * Another suggestion for assessment is for students to keep a daily journal, or use a reflection form for students to process information they learned and reflect on questions they may still have. * You may consider having students (or the class collectively) keep a chart of errors and the ways to fix them. * You can also add vocabulary to a word wall and keep a document or chart of the Python code learned during each mission. * Refer to the Python with CodeX Curriculum Guide or Mission 7 Lesson Prep (found in the l[earning portal](https://learn.firialabs.com/curricula/python-with-codex/teachers-resources/codex-teacher-materials)) for more information. * The teaching guide (below) gives the narration for one way to present the lesson. | | |

**Teaching Guide**

**Warm-up (5 minutes)**

🧑‍🤝‍🧑 **Discuss** – Use a discussion strategy, like journaling, working at boards, selecting random students, or a form of think-pair-share.

* Topic: Topic: Review what students have learned so far in Mission 7. You can also review what students learned about RGB colors.

**Activity – Mission #7 Objectives 7-9 (20 minutes)**

💻 Randomly group students into pairs for pair programming (or they can work individually).

Students log in to one computer. Two computers can be used if they want to have the activity guide open on one computer and CodeSpace on the other computer.

Students go to [make.firialabs.com](http://make.firialabs.com) and should be in Mission 7 at Objective 7. Open the *billboard* program.

💡 **Teaching tip – Objective 7:**

Students learn about strings and add them to the list. The structure of the list needs to be maintained. The string element is in quotation marks, and the comma (,) separating the items is outside the quote marks.

💡 **Teaching tip – Objective 8:**

The code will result in an error. Expect it! The error is fixed in the next objective.

💡 **Teaching tip – Objective 9:**

Students learn about errors, and then fix the type error caused in objective 8. You can spend some time discussing the other errors and what might cause them.

You can decide if you want students to turn in their code at this point. The “After Objective 9” activity is optional, but it is really good practice for the Create PT. So if you have class time to do it, I recommend doing so. If you are short on time, or if some of your students work at a slower pace, you can skip it.

**Activity – After Objective 9 (20 minutes)**

💡 **Teaching tip – After Objective 9:**

With this activity, students have a chance to practice some of the programming skills they have been learning.

Spend the time you have on these additions. If students don’t do them all, that is okay.

* First, RGB colors. Have students add colors to their list using RGB triplets (tuples).
* Second, functions. Have students create at least one function from their program code. The easiest function to create is for displaying the item in the list. Another function could be for changing choice. This function requires the “global choice” line of code. Both functions are similar to the extra code completed in the program for Mission 6 (Heartbeat\_functions).
* Third, kill switch. Students learned that a break statement stops the loop. Students can add another if statement to the main program using a different button.
* Fourth, clear the display. After the while loop ends, use display.fill(BLACK) to clear the screen.
* As an added challenge for highly motivated students, see if they can create a third function that is an introduction. It will display first, and give instructions on what to do.

Example solutions are given for this activity and the challenge.

✅ Assignment is complete and ready to turn in.

**Wrap-Up (5 minutes)**

Use a formative assessment for the wrap-up.

✅ **IMPORTANT!!**

* Remind students to clear their CodeX.

Formative Assessment:

* Daily reflection journal
* Mission 7 Kahoot Review (in class or individual) – all questions can be answered during Objectives 1-6
* Exit ticket on lists or nested if statements.
* Group review on lists or nested if statements.

**SUCCESS CRITERIA:**

* Mix text messages with a selection of images and color.
* Use existing code to create a function.
* Identify errors caused in program code.
* Create and call functions.
* Add a “kill switch” to end the program.