

LOOPS



LESSON OVERVIEW

Loops are a handy way of describing actions that repeat a certain numbers of times. In this lesson, students will practice converting sets of actions into a single loop.

Essential Question: How can we create loops with Tokymaker?

Students will:

- Repeat actions initiated by the instructor
- Translate a picture program into a live-action dance
- Convert a series of multiple actions into a single loop



LESSON TAGS

GRADE LEVEL	SUBJECTS	DIFFICULTY	DURATION
middle school	STEM/STEAM, engineering, computer science	beginner	50 minutes
PREREQUISITE KNOWLEDGE	SUPPLIES	ASSESSMENT	RESOURCES
Hello World: Knows how to use Tokymaker, code blocks in sequence and upload code from the website. Tutorial: Inputs & Outputs	Starter kit (1 kit per group of 2-3 students) MacBook OSX, or Chromebook, or Android Tablet or Android Smartphone with version 6.0 up. Internet	Use this guide to assess students' understanding of the concepts taught in the tutorials.	Tokymaker Workbook Debugging Checklist Loops Answer Key (included at the end)



STANDARDS

ISTE Standards (formerly NETS)

- 1.c - Use models and simulation to explore complex systems and issues.
- 2.d - Contribute to project teams to solve problems.
- 4.b - Plan and manage activities to develop a solution or complete a project.
- 6.a - Understand and use technology systems.

CSTA

CT.L1:3-03. Understand how to arrange information into useful order without using a computer.

CT.L1:6-01. Understand and use the basic steps in algorithmic problem-solving.

CT.L1:6-02. Develop a simple understanding of an algorithm using computer-free exercise.

CT.L1:6-05. Make a list of sub-problems to consider while addressing a larger problem.

CPP.L1.3-04. Construct a set of statements to be acted out to accomplish a simple task.

CPP.L1:6-05. Construct a program as a set of step-by-step instructions to be acted out.

CT.L2-03. Define an algorithm as a sequence of instructions that can be processed by a computer.

CT.L2-06. Describe and analyze a sequence of instructions being followed.

1B-A-3-7: Construct and execute an algorithm (set of step-by-step instructions) which includes sequencing, loops, and conditionals to accomplish a task, both independently and collaboratively, with or without a computing device.

1B-D-4-14: Use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB).

1B-A-5-4: Construct programs, in order to solve a problem or for creative expression, that include sequencing, events, loops, conditionals, parallelism, and variables, using a block-based visual programming language or text-based language, both independently and collaboratively (e.g., pair programming).

2-A-5-6: Develop programs, both independently and collaboratively, that include sequences with nested loops and multiple branches.

2-A-5-7: Create variables that represent different types of data and manipulate their values.

NGSS Science and Engineering Practices

K-2-PS3-2 - Use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem.

Common Core Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
4. Model with mathematics.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Common Core Math Standards

K.CC.4 - Understand the relationship between numbers and quantities; connect counting to cardinality.

K.CC.6 - Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.

K.MD.3 - Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.

Common Core Language Arts Standards

SL.K.1 - Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.

SL.K.2 - Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.

L.K.6 - Use words and phrases acquired through conversations, reading and being read to, and responding to texts.

SL.1.1 - Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups

SL.1.2 - Ask and answer questions about key details in a text read aloud or information presented orally or through other media.

L.1.6 - Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).

SL.2.1 - Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.

SL.2.2 - Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.

L.2.6 - Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using adjectives and adverbs to describe.

VOCABULARY



repeat, forever, if, loop
 random, wait time
 variable, increment
 update, clear



INSTRUCTIONAL STEPS

STEP 1: SETUP - Prior to Class

Duration: 10 minutes

This lesson can be done individually or in small groups (2-3 students).

The tutorials are well explained and do not require teacher guidance to complete, so teachers can focus on supporting students when they need extra help.

Each group will need at least one Tokymaker, a compatible computer, plus one [Tokymaker Workbook](#) per student. Craft materials like cardboard and straws are recommended but not essential.

NOTES

- Set up a screen or a projector to watch the loops video as a class (Step 2: Introduce). Note that this video has sound. If you don't have access to a projector students can view on their laptops.
- [Optional] Print out the Loops Answer Key (see Appendix below). The answer key provides the end code for each tutorial and an explanation of how it works, block by block.
- [Optional] If you are new to code do at least one tutorial beforehand.



STEP 2: INTRODUCE - What is a Loop?

Duration: 10 minutes

This is a great time to review the last lesson that you went through with your class. We suggest you alternate between asking questions of the whole class and having students talk about their answers in small groups.

Here are some questions that you can ask in review:

- What did we do last time?
- What do you wish we would have had a chance to do?
- Did you think of any questions after the lesson that you want to ask?
- What was your favorite part of the last lesson?

Offline and interactive explanation of what is a loop:

- Ask for a volunteer and have them stand
 - Instruct your volunteer to walk around the table (or their chair, or a friend)
 - When they finish, instruct them to do it again, using the exact same words you did before
 - When they finish, instruct again
 - Then again
- Would it have been easier for me to just ask you to go around the table four times?
 - What if I wanted you to do it ten times?
- If I want you to repeat an action 10 times, that's called "looping."
- When I know in advance that I want you to do something a certain number of times, it's easier for both of us if I just ask you to "Repeat it that many times."

- Can you think of some other things that we could loop? Write it in the workbook

Suggested group discussion after the activity ends: *Can you think of an everyday activity that works like a loop?*



STEP 3: TUTORIALS – Let’s play Loops!

Duration: 30 minutes

2.0 Getting Loopy

Sometimes, when you know that you will be doing something over and over, it is helpful to know how many times it needs to be done before you begin. That way, you can keep track of how many actions you have left as you go

Do the exercise as explained in the Appendix.

Let them complete that part in the workbook.

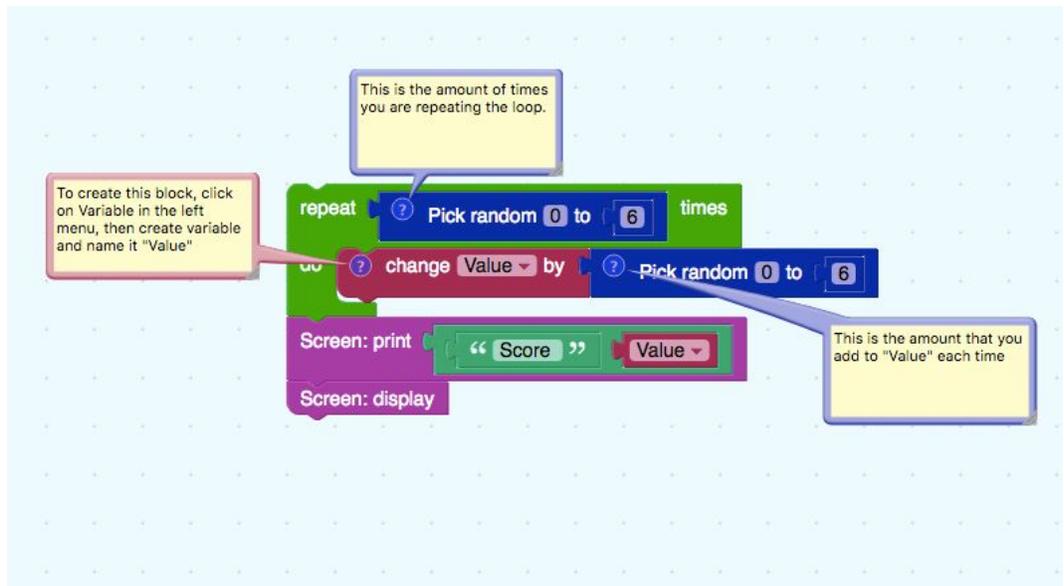
2.1 Loop for fun!

Point out that there are certain loops that happen very frequently, for example, loops where you need to keep track of how many times you have been through

- Sometimes, you don't want to start with one
- Sometimes, you don't want to count by ones
- For Loops give you a powerful way to keep a counter that starts when you want, ends when you want, and increases by whatever size step that you want

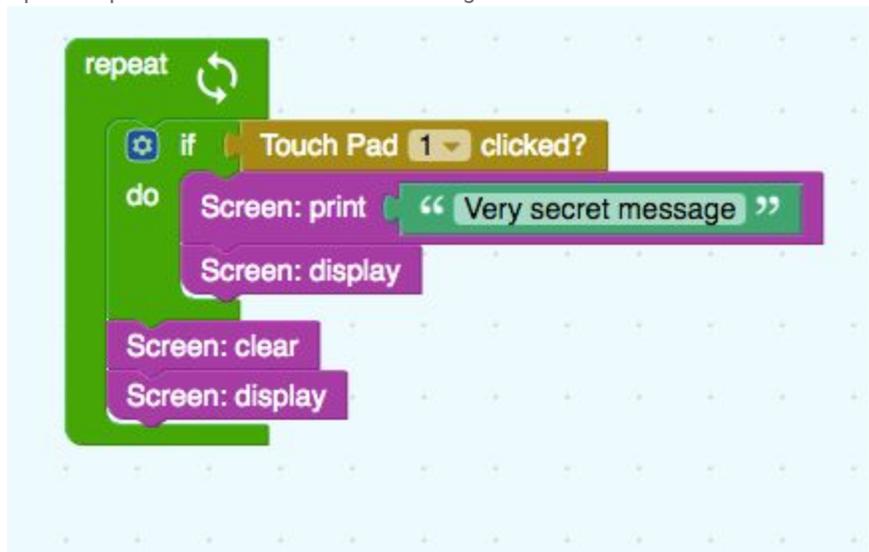
Here, you can jump right into a sample of the game. See the Appendix to know more.

Now They have to understand the analogy with the Tokymaker code. To do this, they have to discuss what are the similarities between the Fun for loop game and the code below.



2.2 Shh! It's A Secret Message

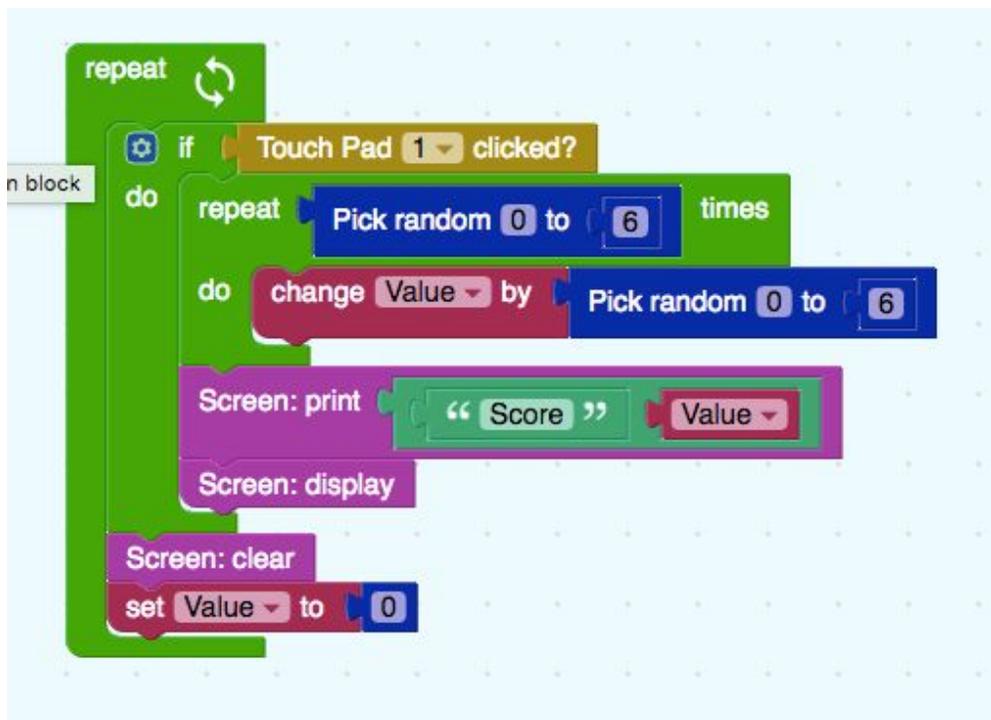
Students will make a secret message appear when they press a touchpad. They will learn how to use a repeat loop and if/do block to hide a message.



2.3 Loop for fun game with the Tokymaker

Go to <http://tokylabs.com/project/Tutorial-lesson-2-Loops/> and download the code "Loop for Fun" or create it yourself for this exercise

They will do in a single exercise most of the loops. Ask them to think what they have learned about the Repeat loop, Repeat X times loop, and If/do condition. See Appendix to read a detailed block explanation.



Upload the code to the Tokymaker and play the same game again in pairs.



STEP 4: SHARE - What Did You Learn? What Do You Need Help With?

Duration: 5 minutes

Ask students to complete the Loops section of their Tokymaker Workbook.

[Optional] Ask students to share on a post-it: One thing they learned and one thing they need help with. Post their reflections on a designated wall or board. Encourage them to read the Post-Its and use them as a tool to help each other during the next class.



STEP 5: CLOSE

Duration: 5 minutes

Students should take apart their Tokymaker and put away the sensors in the box in order. Students should clean up their workspace and close out their app.

APPENDIX

CODE TUTORIALS | **LOOPS ANSWER KEY**

2.0 GETTING LOOPY

Ask the students to look at the dance moves provided on the workbook

1. Show the class what the entire dance looks like done at full-speed.

- Run through the dance slowly, one instruction at a time, with the class.
- Can you find the loop in the instructions?
- Can you find anything else in the dance that we could use a loop for?

The Iteration

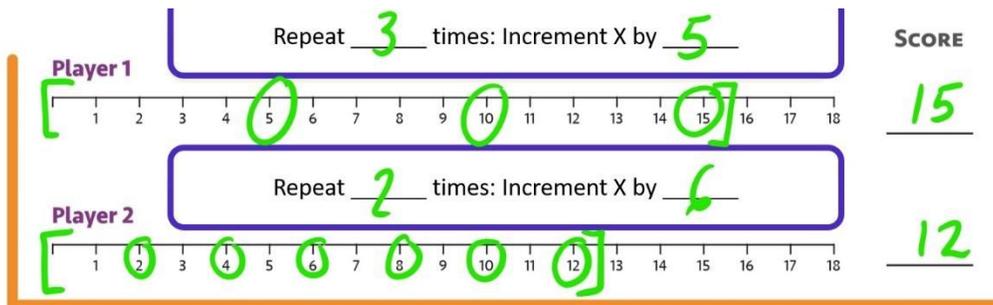
*Repeat this part
3 times!*

			
Clap	Clap	Clap	
			
Behind Head	Waist	Behind Head	Waist
			
Clap	Clap	Clap	
			
Left Up	Right Up	Left Up	Right Up
			
Clap	Clap	Clap	
<i>Then do this</i>			
			
Belly Laugh			

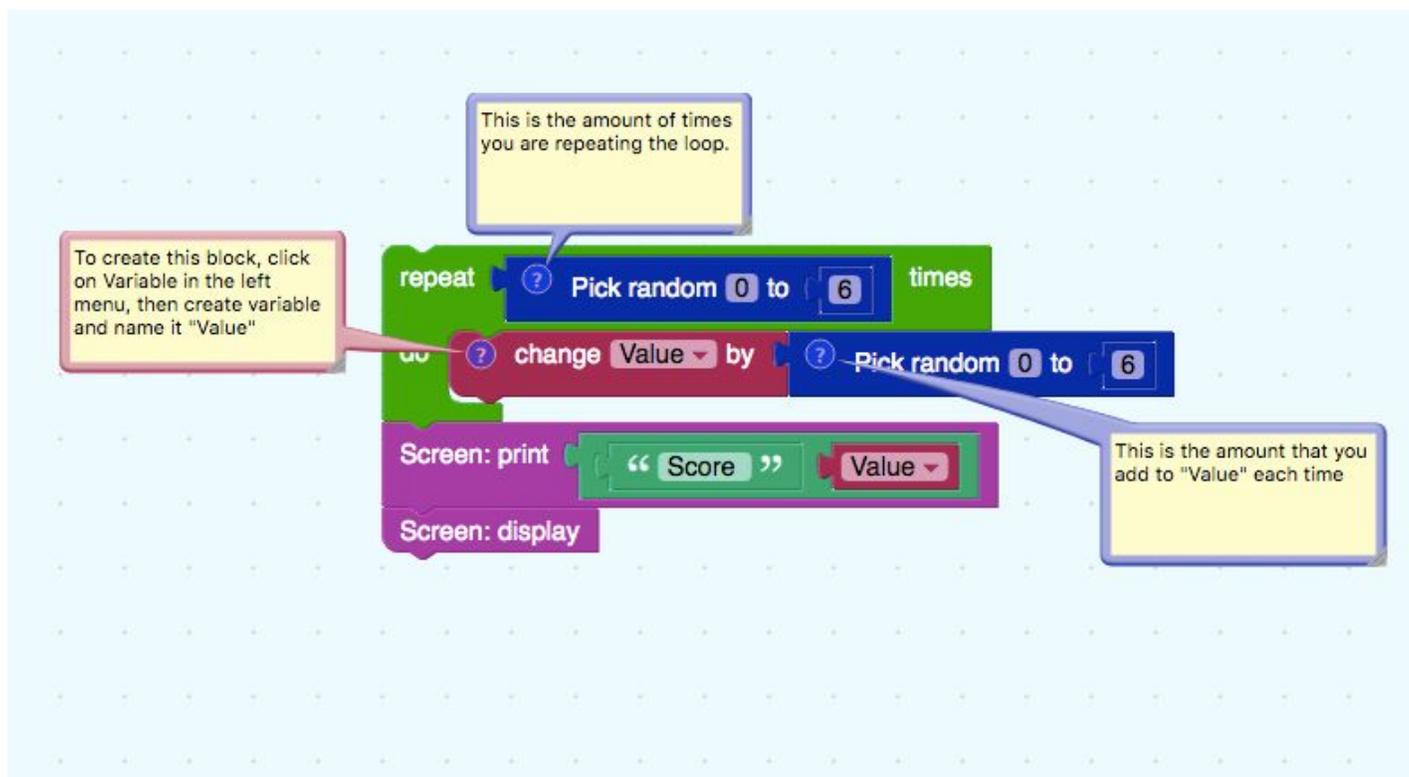
2.1 LOOP FOR FUN, OFFLINE

Directions:

1. 1.- Divide students into pairs
2. 2.- To start the round, each student rolls two times:
 - One die to determine how many times will the loop repeat.
 - One die to determine the step interval of X each time through
3. 3.- Use one of the provided number lines to trace the for loop that they've made
 - Start at the starting value of X which is 0
 - Count down the number line, circling the numbers at the rolled interval
 - Stop when you finish all the iterations.
4. 4.- Add all of the circled values to your score, then let the other player take a turn
5. 5.- Best 2 out of 3 wins



FINAL CODE



HOW IT WORKS

The green [REPEAT X NUMBER OF TIMES] loop block tells the code inside it to keep running as many times as the number you place in the empty space (because a game that only runs once is not very exciting).

In this case we placed a blue [PICK RANDOM from Num 1 to Num 2] number block. So the code will repeat a random number of times.

The red [CHANGE VALUE BY X NUMBER] variable block is incrementing the variable “value” by the number you place in the empty space. Again, we placed another blue [PICK RANDOM NUMBER] number block.

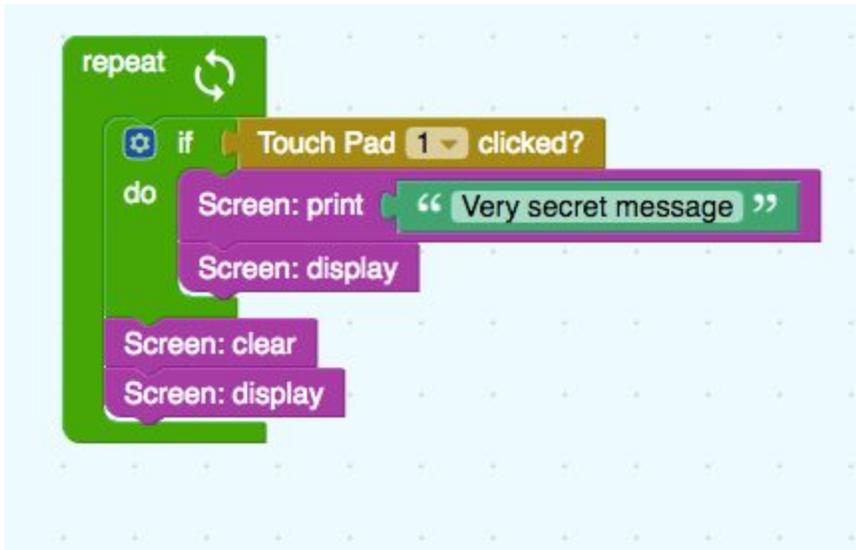
Once the process of the “Repeat random number of times” loop is completed, the purple [SCREEN PRINT TEXT + NUMBER] Display block will prepare the number stored in the red variable [VALUE].

Finally, the purple [SCREEN: DISPLAY] display block is sending the information to the screen to be shown. That is the instruction that actually send the content to the screen.

CODE TUTORIALS | LOOPS ANSWER KEY

2.1 SHHH! IT’S A SECRET MESSAGE

FINAL CODE



HOW IT WORKS

The green [REPEAT] loop block tells all the code inside it to keep running forever.

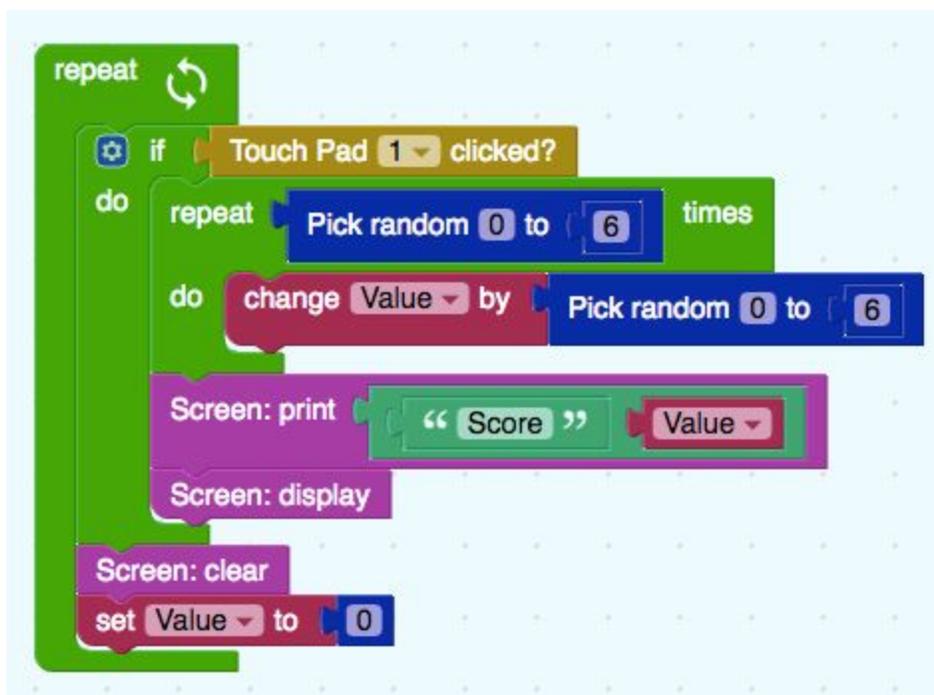
The [IF, DO] loop block which is “nested” inside the [REPEAT] block tells our code to do something only if certain conditions are true. In this case, it will do the code inside of it only if the yellow [TOUCH PAD 1 CLICKED?] input block is true.

The purple [SCREEN PRINT TEXT] Display block will prepare the text written in the green [TEXT] text block. the purple [SCREEN: UPDATE] display block is sending the information to the screen to be shown. That is the instruction that actually send the content to the screen. After sending the message to the screen, the screen prepares to clear up with the purple [SCREEN: CLEAR] display block and the purple [SCREEN: DISPLAY] display to actually execute that clear action.

CODE TUTORIALS | **LOOPS ANSWER KEY**

2.2 LOOPS FOR FUN WITH THE TOKYMAKER

FINAL CODE



HOW IT WORKS

This code is a more precise version of the Loop for Fun code. Here we are including all the blocks needed to run it on the Tokymaker.

You will notice that this example is a mix of the last two:

The green [REPEAT] loop block tells the code inside it to keep running forever (because a game that only runs once is not very exciting).

The [IF, DO] condition block which is “nested” inside the [REPEAT] block tells our code to do something only if certain conditions are true. In this case, it will do the code inside of it only if the yellow [TOUCH PAD 1 CLICKED?] input block is true.

Inside, the green [REPEAT X NUMBER OF TIMES] loop block tells the code inside it to keep running as many times as the number you place in the empty space (because a game that only runs once is not very exciting).

In this case we placed a blue[PICK RANDOM from Num 1 to Num 2] number block. So the code will repeat a random number of times.

The red [CHANGE VALUE BY X NUMBER] variable block is incrementing the variable “value” by the number you place in the empty space. Again, we placed another blue [PICK RANDOM NUMBER] number block.

Once the process of the “Repeat random number of times” loop is completed, the purple [SCREEN PRINT TEXT + NUMBER] Display block will prepare the number stored in the red variable [VALUE]. Then, the purple [SCREEN: DISPLAY] display block is sending the information to the screen to be shown. That is the instruction that actually send the content to the screen.

When the Touch Pad is clicked and the information is finally shown in the screen, we go out of the [IF DO] condition block. Then, it’s time to clear the screen by adding two instructions: ,The screen prepares to clear up with the purple [SCREEN: CLEAR] display block and the red block sets the value again at 0 so we can begin again.