

Lesson 9: Random

45 minutes

Overview

How can I generate and use random numbers?

Students revisit the `Math` class and learn to use the `Math.random()` method to generate random numbers. Students explore how to manipulate the values returned from `Math.random()` to produce a random `int` or `double` in a specific range. Students then practice generating and using random numbers.

Standards

Full Course Alignment

CSA Conceptual Framework

- **CON-1** - The way variables and operators are sequenced and combined in an expression determines the computed result.

Agenda

Warm Up (10 minutes)

CS Pyramid

Activity (30 minutes)

Random Numbers

Using Random Numbers

Wrap Up (5 minutes)

Software Engineering Skills

Assessment: Check for Understanding

AP Classroom Topic Questions

Objectives

Students will be able to:

- Use `Math.random()` to generate random numbers
- Write expressions using `Math.random()` to generate random numbers within a specific range

Preparation

- Create code review groups if you are not reusing the same groups
- Check the **Teacher's Lounge** for verified teachers on the CSA Forum to find additional strategies or resources shared by fellow teachers

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the students

- **Random Numbers** - Video
- **U4L9 Extra Practice** - Handout

Teaching Guide

Warm Up (10 minutes)


CS Pyramid

 *Remarks*

We have learned a lot of new terms so far! Let's review some of these terms through a game of CS Pyramid.

Group: Place students in pairs.

 **Do This:** Review the instructions for playing CS Pyramid.


 **Do This:** Play the music clip to cue the CS Pyramid activity, and direct students to play CS Pyramid. Click through the animated slide to display each pyramid, and direct students to switch roles with each new pyramid.


Activity (30 minutes)

Random Numbers (15 minutes)

Remarks

We previously explored some of the methods in the `Math` class for performing calculations. The `Math` class also has a method for generating random numbers.

 **Do This:** Review the lesson objectives.

 **Do This:** Direct students to Level 1 on Code Studio to predict the program's outcome, then run the program to compare their predictions to the actual outcome.


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Predict: Random Numbers

 **Discuss:** Click through the animated slide to display the prompts.

- *What do you notice about the code in this program?*
- *What do you wonder about the code in this program?*

Discussion Goal: Students notice that the program displays a different number each time they run it and that the random number is always a `double` value. Students may wonder how to generate a random number within a specific range or how they could use random numbers in their programs.

 **Do This:** Review the `Math` class and introduce `Math.random()`.

Remarks

A random number between 0.0 and 1.0 is not always useful depending on the needs of our program. However, we learned about casting operators and ways to round numbers. These operators and strategies might be useful with `Math.random()` to get a random number within a specific range, like between 1 and 10.

 **Discuss:** Use the Retrieve-Pair-Share strategy to discuss the prompt.

- *How could we write an expression using `Math.random()` to generate a random number within a specific range?*

Discussion Goal: Students suggest using casting operators to convert the value returned to an `int` value. Students recall adding 0.5 to round a number to the nearest integer and may suggest adding a value to the number generated to get a number within a specific range.

Students may have other ideas about generating a random number within a specific range instead of or in addition to adding a value to the number returned from calling `Math.random()`. It is not important for students to reach this conclusion during this discussion, as they will test their ideas to reach this conclusion on Level 2. The goal is for students to generate ideas about how to solve this problem.

Group: Place students in pairs.

Do This: Direct students to Level 2 on Code Studio to investigate the program with a partner. Students make the changes to the program as prompted.



Investigate: Generating Random Numbers

Display: Show the video - *Random Numbers*.

Do This: Click through the animated slide to demonstrate generating a random number within a specific range using `Math.random()`.

Using Random Numbers (15 minutes)

Remarks

Random numbers are useful for making our programs more interesting. We see randomness in many programs that we use every day.

Discuss: Use the Retrieve-Pair-Share strategy to discuss the prompt.

- *What are programs that you use that have a random component?*

Discussion Goal: Students share programs that they use that have a random component, such as enemies appearing in different locations in games or playing a music playlist on shuffle.

Do This: Direct students to Level 3 on Code Studio to complete Levels 3 and 4. Students use `Math.random()` to generate a random number within a specific range on Level 3, then continue to Level 4 to complete a choice level.



Using Random Numbers

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Do This: Click through the animated slide to have students participate in the Code Review Call and Response.

Do This: Direct students to complete a code review on Level 5.



Code Review: Using Random Numbers

Wrap Up (5 minutes)

Software Engineering Skills

Remarks

Software engineers write algorithms to process and analyze data in programs to answer questions and solve problems. You have made a lot of progress developing your software engineering skills in this unit as you learned how to work with data to find information.

 **Discuss:** Click through the animated slide to display the prompts.

- *How has your perception of software engineering changed in this unit?*
- *How have your software engineering skills improved in this unit?*

Discussion Goal: Students share how their perception of software engineering has changed, including how computer science influences different industries and decisions. Students identify the software engineering skills and characteristics they feel they improved in this unit.

 **Do This:** Review the concepts covered in this lesson.

Assessment: Check for Understanding

Check For Understanding Question(s) and solutions can be found in each lesson on Code Studio. These questions can be used for an exit ticket.



AP Classroom Topic Questions

To assign questions from the AP Classroom Question Bank that align with this lesson, create a custom quiz in AP Classroom by searching the Question Bank for the Essential Knowledge statements listed at the top of this lesson plan. You can find instructions and video demonstrations to do this on **AP Central**.

The following Topic Questions in AP Classroom can be assigned as a formative assessment for this lesson:

- Topic Questions 2.9

Note: *Some Learning Objectives and Essential Knowledge statements in the suggested Topic Questions are covered in later units.*



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