

## **WAMC Lab Template**

Math Concept(s): Probability

Source / Text: N/A

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### **Attach the following documents:**

- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

### **Short Description (Be sure to include where in your instruction this lab takes place):**

- Students will experience the law of large numbers and how it applies to probability by flipping a coin and trying to get a certain sequence.

### **Lab Plan**

Lab Title:

Heads or Tails

Prerequisite skills:

Students will need to know some probability, averages, graphing

Lab objective:

**Standards:** *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*

Mathematics K–12 Learning Standards:

- **7.SP.C.8** Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
- **HSS-ID.A.4** Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages.
- **HSS-CP.B.9** Use permutations and combinations to compute probabilities of compound events and solve problems.

Standards for Mathematical Practice:

- 2. Reason abstractly and quantitatively.
- 4. Model with mathematics.
- 8. Look for and express regularity in repeated reasoning.

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- **RST.6-8.3** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- **RST.6-8.7** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

- **SL.8.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

K-12 Science Standards

- **HS-LS3-3** Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Technology

- N/A

Engineering

- N/A

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)			
<input type="checkbox"/> Global Awareness	<input type="checkbox"/> Financial/Economic/Business/Entrepreneurial Literacy	<input type="checkbox"/> Civic Literacy	
<input type="checkbox"/> Health/Safety Literacy	<input type="checkbox"/> Environmental Literacy		
21st Century Skills (Check those that students will demonstrate in the above activity.)			
<b>LEARNING AND INNOVATION</b>	<b>INFORMATION, MEDIA &amp; TECHNOLOGY SKILLS</b>	<b>LIFE &amp; CAREER SKILLS</b>	<b>Productivity and Accountability</b>
<u>Creativity and Innovation</u>	<u>Information Literacy</u>	<u>Flexibility and Adaptability</u>	<u>Accountability</u>
<input type="checkbox"/> Think Creatively	<input type="checkbox"/> Access and Evaluate Information	<input type="checkbox"/> Adapt to Change	<input type="checkbox"/> Manage Projects
<input type="checkbox"/> Work Creatively with Others	<input type="checkbox"/> Use and manage Information	<input checked="" type="checkbox"/> Be Flexible	<input checked="" type="checkbox"/> Produce Results
<input type="checkbox"/> Implement Innovations	<u>Media Literacy</u>	<u>Initiative and Self-Direction</u>	<u>Leadership and Responsibility</u>
<u>Critical Thinking and Problem Solving</u>	<input type="checkbox"/> Analyze Media	<input type="checkbox"/> Manage Goals and Time	<input type="checkbox"/> Guide and Lead Others
<input checked="" type="checkbox"/> Reason Effectively	<input type="checkbox"/> Create Media Products	<input checked="" type="checkbox"/> Work Independently	<input type="checkbox"/> Be Responsible to Others
<input type="checkbox"/> Use Systems Thinking	<u>Information, Communications and Technology (ICT Literacy)</u>	<u>Social and Cross-Cultural</u>	
<input type="checkbox"/> Make Judgments and Decisions	<input type="checkbox"/> Apply Technology Effectively	<input checked="" type="checkbox"/> Interact Effectively with Others	
<input type="checkbox"/> Solve Problems		<input type="checkbox"/> Work Effectively in Diverse Teams	
<u>Communication and Collaboration</u>			
<input checked="" type="checkbox"/> Communicate Clearly			
<input checked="" type="checkbox"/> Collaborate with Others			

**Teacher Preparation: (What materials and set-up are required for this lab?)**

Materials

- Pencil
- Lab handout
- A quarter

Set-Up Required:

- Make sure each student gets a quarter

**Lab Organization Strategies:**

Leadership (Connect to 21<sup>st</sup> Century Skills selected):

- Students will work independently, then come together to share their own data as a class. Students are expected to find their own accurate data so when the class comes together, the data won't be false.

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### Cooperative Learning:

- Each student will be responsible for completing their own coin flips and recording accurate data for the class.

### Expectations:

By the end of lab, students should be able to:

- Understand that expected values and actual values may be different.
- When it comes to larger sample sizes, expected starts to turn into actual.

### Timeline:

- Small introduction (what should we expect) ~ 5 minutes.
- Flipping and recording the coin ~ 5 to 10 minutes (some may finish early. Others might not finish.)
- Combining data and observing ~ 10 minutes
- Coin flip website

### Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Better understanding of how percentages and probabilities work. Odds may seem deceiving.

### Career Applications

- Anything or anytime percentage chances are involved, from medical treatment, data analytics, weather.

### Optional or Extension Activities

- Any coin flip simulator can show the law of large numbers well. They can also flip thousands of coins at a time.
- As an extension, students can flip for combinations larger than three, i.e. HHTH

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## Instructions

Today, we are flipping coins until we match a desired outcome.

### Step 1. Materials

You will need a handout, a pencil, and a quarter.

### Step 2. Flipping the coin

You will flip a coin three times in a row. The goal is to match the combination given by the teacher.

If the combination matches, mark down that you got it in one and you're done!

If the combination does not match, mark a tally on your paper and try again until you match.

### Step 3. Collecting data

Once all students are done flipping their coin, we will come together and mark their total number of attempts on a dot plot.

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## Student Handout

Probability doesn't contain the word "probably" for no reason! Today, we are going to put probability to the test.

Before we start flipping our coin, let's talk about what we should expect.

1. What is the probability of flipping one coin and landing on heads? What about tails?
2. What about the probability of flipping a coin twice and landing on heads both times? Is it the same probability in the first question? Why or why not?

Alright, let's start flipping the coin. Remember, you want to mark down every attempt, then start flipping the coin. Keep going until you get the exact combination I give you. Once you do, you can stop marking.

Once everyone is done, create a dot plot below showing how many attempts everyone took.

## Student Handout (cont.)

3. What is the average number of attempts across the entire class?

4. How many total possible three flip combinations are there?

5. Take the average in question 3 and divide by the answer in question 4. Is this number significant? Is it close to something that is?

6. Consider doing more attempts. Roughly how many times would it take to flip a specific four-flip combination? What about a five-flip combination?

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Requirements	Possible Points	Your Score
Questions 1-6 answered	5	
Attempt(s) marked down	10	
Dot plot made and graphed	10	
<b>Total</b>	<b>25</b>	

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