

## **WAMC Lab Template**

Math Concept(s): **Experimental Probability**

Source / Text: **HMH GoMath**

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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 play games of chance.
- Students then create a carnival game and use probability to predict outcomes. Students will then try games and see if their predicted outcomes match their experimental outcomes.

### **Lab Plan**

Lab Title: **Carnival Games**

Prerequisite skills: **Simplifying Fractions, Converting fractions into decimals, and percentages and decimal.**

Lab objective: **To have students apply actual experimental probability to real-life games of chance.**

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

**Mathematics K–12 Learning Standards:**

- 7.RP.3 Use proportional relationships to solve multistep ratio and percent problems.
- 7.SP.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring...
- 7.SP.C.6 Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.
- 7.SP.C.7 Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
- 7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

**Standards for Mathematical Practice:**

- MP 1: Make sense of problems and persevere in solving them.
- MP 3: Construct viable arguments and critique the reasoning of others.
- MP 4: Model with mathematics.
- MP 6: Attend to precision.

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

- ELA-WRITING STANDARDS 7. Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
- ELA-LITERACY.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).

K-12 Science Standards

- N/A

Technology

- N/A

Engineering

- HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Leadership/21st Century Skills:

<u>21st Century Interdisciplinary themes</u> (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		
<u>21st Century Skills</u> (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 checked="" 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 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 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>	<input type="checkbox"/> Be Self-Directed Learners	
<input type="checkbox"/> Make Judgments and Decisions	<input checked="" type="checkbox"/> Apply Technology Effectively	<u>Social and Cross-Cultural</u>	
<input type="checkbox"/> Solve Problems		<input type="checkbox"/> Interact Effectively with Others	
<u>Communication and Collaboration</u>		<input type="checkbox"/> Work Effectively in Diverse Teams	
<input type="checkbox"/> Communicate Clearly			
<input type="checkbox"/> Collaborate with Others			

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

**Materials**

- Cardboard
- X-Acto Knife (Box cutter)
- Scissors
- Small variety of ping pong balls
- Colored paper
- Cups
- Markers
- Trifold Displays

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- Tape and/or glue (hot glue too)

#### Set-Up Required:

- Students will need a flat surface to create their designs. Students will need help with deep cuts or hotglue.

#### **Lab Organization Strategies:**

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

- **LEARNING AND INNOVATION** – Think Creatively – Students will design their own logo that is a simple representation of themselves or something they enjoy.
- **LIFE & CAREER SKILLS** – Work Independently – Students will keep pace with their own timeline to create, design, and present their own logo.

##### Cooperative Learning:

- After the design process, students will be able to play other student's games of chance to help with experimental probability.

##### Expectations:

- Students will be expected to do some research about carnival games that are reasonable to make within the classroom.
- Students will then design and keep their goal and time for completion of the product.

##### Timeline:

- The original lesson is about 2 days, but this project will take students about 5 days. 1 day to brainstorm. 2 days to create and build their game. 1 day to finalize and gather data. 1 day to host the carnival event.

#### **Post Lab Follow-Up/Conclusions:**

##### Discuss real world application of learning from lab

- Weather forecasting is the most common example of probability. How likely it is that there will be rain, snow, clouds, etc. on a given day in a certain area.
- Sports betting for companies to determine the odds they should set for certain teams to win certain games. Then companies will offer a higher payout for people who bet on a time to win.
- Health insurance uses probability to determine how likely it is that certain individuals will spend a certain amount on healthcare each year.

##### Career Applications

- Recruiter
- Actuary
- Financial Analyst

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## Lab instructions

### Design/Create a Carnival game

- Create a Carnival Game of chance!
- Your goal is to make a carnival game that has fair chances, however, you want to make money as well!
  - That means patrons have to be able to win (or else they won't play)
  - BUT you need to be able to make a profit
- Design a Carnival Short Game that will make you money.
- Your game must include different tier levels of prizes and ways to win as well as a "strike out" zone.
- Record possible outcomes of the game and predict profit from your game.
- Then have patrons play your game and record their real-time data as they're playing.
- Make sure to write clear and concise directions for your game so your patrons can understand.

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## Student Handouts – Probability Outcomes

Determine several possible outcomes for your game. Then give the probability of each outcome as a fraction and use the words, “likely”, “unlikely”, “impossible”, or “certain.”

Possible Outcome	Probability Using a Fraction	Probability Using a Word

**Rubric (assessments)**

**Mathematical Measurements:**

Standard Measured	Level 1 – Below	Level 2 – Approach	Level 3 – Meet	Level 4 - Exceed
Student correctly identified the games probable outcome.				
Student predicted possible outcomes for the game.				
Student correctly identified the probability of each outcome as a fraction.				
Student correctly identified the probability of each outcome as a word.				

**Design Measurements:**

Standard Measured	Level 1 – Below	Level 2 – Approach	Level 3 – Meet	Level 4 - Exceed
Student designed a probability based game.				
Student's game is visually appealing and functional.				
Student wrote clear directions for the game.				