**CARNIVAL GAME PROJECT**

**Objective:** Design a carnival game.

* Make a **Working** game. It must be a working, playable game to collect data. It can be a scaled model but it must be playable.
* Collect experimental data for your game on **Carnival Day**. You must have at least 30 plays recorded to calculate your experimental probabilities.
* Complete the Probability Calculation Sheet
* Complete a **typed** report detailing the following **(SEE RUBRIC):**
	+ Rules of the Game
	+ Theoretical probability
	+ Experimental probability of winning the game
	+ Expected payoff for the player
	+ Expected profit or loss
	+ Why your game should be selected to be a permanent addition to the carnival

**Time Line:**

* **Wednesday, Oct. 25th** Project is discussed in class and Groups (of 2) are chosen.
* **Friday, Nov. 3rd – Wednesday, Nov. 8th -** In class work days
	+ This will be your only days to work in class on this project
	+ It is expected that you will spend time outside of class working as well
* **Thursday, Nov. 9th All Projects are DUE IN CLASS!! No Projects accepted Late!**
* **Friday, Nov. 10th** Carnival Day during class
	+ Experimental Probability data will be collected this day by your team
	+ You will take turns manning your game and going to play the other games
* **Monday, Nov. 13th -** In class time to complete report
* **Tuesday, Nov. 14th**- Report is due, not reports will be taken late.

**Grading:**

* **The game will be a quiz grade.**
	+ It will be graded on carnival day by your classmates
	+ Point values will be assigned as follows:
* **25 points** - The game is really amazing. Completely fun to play and evident that the group put a lot of work into creating it.
* **20 points** - The game is well-made, easy to play
* **15 points** -The game is present and playable, but problems of design or construction are evident.
* **10 points** - The game is present but is difficult to play and poorly made.
* **5 points** - The game is present, but it is not playable
* **0 points** - The game is not included.
	+ The scores you receive will be averaged and every member of your group will receive this quiz grade.
* **The report and calculations will be a test grade.**
	+ Each individual must turn in a report.
	+ Rubric is attached.

**Notes & Definitions:**

**Definition of Theoretical Probability**

Probability is a likelihood that an event will happen.

Find the theoretical probability of an event using the ratio: 

**Example of Theoretical Probability**

**Find the probability of getting a sum of 7 when you roll two dice.**

Two dice are being rolled. The possible outcomes are as follows:

Let’s use the representation (a, b) for the outcomes where **a = number on dice 1** and **b = number on dice 2**.

(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6),
(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6),
(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6),
(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6),
(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6),
(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)

There are 36 possible outcomes in all.

**The question is when you roll two dice, what are the chances of getting a sum of 7?**

From the list above identify the pairs with outcomes that add up to 7.

Let’s highlight them this way:

(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), **(1, 6),**
(2, 1), (2, 2), (2, 3), (2, 4), **(2, 5),** (2, 6),
(3, 1), (3, 2), (3, 3), **(3, 4),** (3, 5), (3, 6),
(4, 1), (4, 2), **(4, 3)**, (4, 4), (4, 5), (4, 6),
(5, 1), **(5, 2)**, (5, 3), (5, 4), (5, 5), (5, 6),
**(6, 1)**, (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)

Observe that the pairs along the main diagonal add up to 7. There are 6 such pairs.

So, the probability of getting a sum of 7 when we roll two dice is:


**Definition of Experimental Probability**

Experimental probability of an event is the ratio of the number of times the event occurs to the total number of trials.

**Example of Experimental Probability**

* John rolled flipped a coin 50 times. A tails appeared 23 times.
* Then the experimental probability of a coin coming up tails is 23 out of 50 or 23%.

**Example of Expected Value (or Expected Payoff)**

* You are made the following proposal: You pay $2 for the right to roll a die once. You then roll the die and are paid the number of dollars shown on the die.
* Should you play?
* The ***expected payoff***of the uncertain die throw:





* The expected payoff from the die throw is greater than the $2 price, so a player accepts the proposal.

**Probability Calculation Page Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Each member of the group must complete this page and turn it in with their report on Tuesday, Nov. 14th.

Name of your Game:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Theoretical probability of winning the game (Show how you calculated this probability.):
2. experimental probability of winning the game: (calculated after the games are played)
3. expected payoff (Show how you calculated this expected payoff.)
4. profit or loss (calculated after the carnival is completed)

**Report Rubric**

**a.** Theoretical probability of winning the game

* **15 points** — Correct computation of theoretical probability of winning the game.
* **10 points** — Has some errors in computing probabilities.
* **5 points** — Gives only one probability or has major errors.
* **0 points** — Does not give or address correctly any probabilities.

**b.** Experimental probability of winning the game

* **15 points** — Correct computation of experimental probability. Meets 30+ trials limit.
* **10 points** — Has some errors in computing probabilities. Not enough trials completed.
* **5 points** — Gives only one probability or has major errors.
* **0 points** — Does not give or address correctly any probabilities.

**c.** Expected payoff

* **15 points** — Gives correct expected payoff and explains how it was calculated.
* **10 points** — Gives correct expected payoff, but fails to explain how it was calculated. Or, makes an error in calculation.
* **5 points** — Makes an error in calculation and fails to explain expected payoff.
* **0 points** — Does not give expected payoff.

**d.** Profit or loss

* **10 points** — Correctly computes profit, and explains how it is made.
* **5 points** — Correctly computes profit, but provides no explanation or has major errors.
* **0 points** — Does not address profit.

**e.** Rules of the game

* **10 points** — Clearly states rules, which are easy to understand.
* **5 points** — Gives rules, but does not clearly state them.
* **0 points** — Does not give any rules.

**f.** Prizes and how to earn the prizes

* **10 points** — Lists prizes with cost.
* **5 points** — Lists prizes, but gives no cost.
* **0 points** — Report does not list prizes.

**g.** Why the game should be selected for the carnival

* **10 points** — Addresses why people would want to play the game & why it should be in the carnival.
* **5 points** — Explains why people would want to play the game or why it should be in the carnival, but not both.
* **0 points** — Does not offer any explanation of why the game should be selected.

**h.** Mechanics of Report

* **10 points** — Report is typed and free of grammatical errors
* **5 points** — Report is typed but has some grammatical errors, or report is grammatically correct but not typed.
* **0 points** — Report is neither typed nor free from grammatical errors

**i.** Mechanics of Report

* **5 points** — Probability Calculation Sheet is turned in with report and is complete
* **0 points** — Probability Calculation Sheet is not turned in with report or is turned in incomplete

**j.** Late Penalty:

* **-10 points** for each day that report is late

**Extra Credit (Innovation/Creativity up to 5 points):**

TOTAL SCORE: \_\_\_\_\_\_\_\_/100 pts