

Class Time:

Names:

Discrete Random Variables: Discrete Distribution Lab II

Student Learning Outcomes:

- The student will compare empirical data and a theoretical distribution to determine if a Tet gambling game fits a discrete distribution.
- The student will demonstrate an understanding of long-term probabilities.

Supplies:

- 1 game “Lucky Dice” or 3 regular dice

Note: See #14 in the homework for a detailed game description.

Note: Round relative frequencies and probabilities to four decimal places.

The Procedure

- The experiment is to bet on one object. Then, roll 3 Lucky Dice and count the number of matches. The number of matches will decide your profit.
- What is the theoretical probability of 1 die matching the object? _____
- Choose one object to place a bet on. Roll the 3 Lucky Dice. Count the number of matches.
- Let X = number of matches. Theoretically, $X \sim B(\text{____}, \text{____})$
- Let Y = profit per game.

Organize the Data

1. In the chart below, fill in the Y value that corresponds to each X value. Next, record the number of matches picked for your class. Then, calculate the relative frequency.

x	y	frequency	relative frequency
0	_____	_____	_____
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____

2. Calculate the following

- $\bar{x} =$ _____
- $s_x =$ _____
- $\bar{y} =$ _____
- $s_y =$ _____

3. Explain what \bar{x} represents.

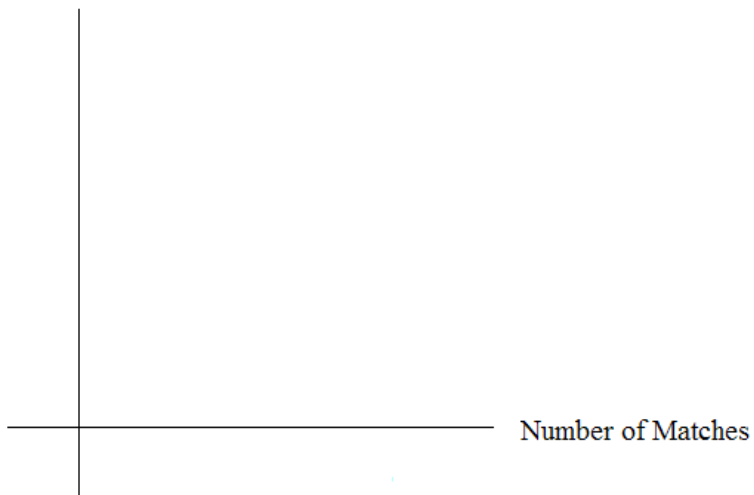
4. Explain what \bar{y} represents.

5. Based upon the experiment:

- What was the average profit per game? _____
- Did this represent an average win or loss per game? _____
- How do you know? Answer in complete sentences.

6. Construct a histogram of the empirical data.

Relative Frequency



Theoretical Distribution

1. Build the theoretical PDF chart for X and Y based on the distribution in Part 1.

x	y	P(X = x) = P(Y = y)
0		_____
1		_____
2		_____
3		_____

2. Calculate the following

- $\mu_x =$ _____
- $\sigma_x =$ _____
- $\mu_y =$ _____

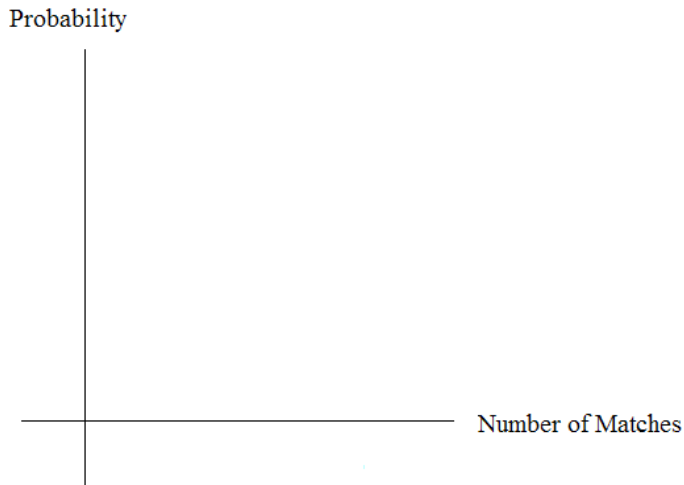
3. Explain what μ_x represents.

4. Explain what μ_y represents.

5. Based upon theory:

- What was the expected profit per game? _____
- Did the expected profit represent an average win or loss per game? _____
- How do you know? Answer in complete sentences.

6. Construct a histogram of the theoretical distribution.



Use the Data

Calculate the following (rounded to 4 decimal places):

NOTE: RF = relative frequency

Use Information from “Theoretical Distribution” here:

- $P(X = 3) = \underline{\hspace{2cm}}$
- $P(0 < X < 3) = \underline{\hspace{2cm}}$
- $P(X \geq 2) = \underline{\hspace{2cm}}$

Use information from “Organize the Data” here:

- $RF(X = 3) = \underline{\hspace{2cm}}$
- $RF(0 < X < 3) = \underline{\hspace{2cm}}$
- $RF(X \geq 2) = \underline{\hspace{2cm}}$

Discussion Questions

For questions 1. and 2., consider the graphs, the probabilities and relative frequencies, the means and the standard deviations.

1. Knowing that data vary, describe three similarities between the graphs and distributions of the theoretical and empirical distributions. Use complete sentences.

2. Describe the three most significant differences between the graphs and distributions of the theoretical and empirical distributions.

3. Thinking about your answers to 1. and 2., does it appear that the data fit the theoretical distribution ? In 1 - 3 complete sentences, explain why or why not.

4. Suppose that the experiment had been repeated 500 times. Which table (from "Organize the Data" and "Theoretical Distribution") would you expect to change? Why? How might the table change?