Binomial and Uniform Distribution

Roll a pair of dice 20 times and record the amount of 6’s that you roll in each toss:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of 6’s | Tally of 6’s rolled in with 2 dice rolled | Theoretical probability | Experimental probability (yours) | Experimental Probability (class) |
| 0 |  |  |  |  |
| 1 |  |  |  |  |
| 2 |  |  |  |  |

Do you notice anything?

What is the Theoretical probability of each outcome:

Let’s do the sample space:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |

Fill in the chart above with your answers

What do the probabilities add up to when you add them all together?

Why does this make sense?

Do you think it would always happen like this?

What is the probability of rolling any single digit (1-6) on each roll?

|  |  |
| --- | --- |
| Digit | Theoretical Probability |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |

What does this probability add up to?

Now if we were to draw a histogram for each of the above theoretical probabilities it would look like this:

Which of the above would you say is uniform and which is a Binomial Distribution?

Match the following definitions with proper definition

Uniform Distribution Is the probability distribution when there are a fixed number of trials in which the outcomes are classified as successes or failures.

Binomial Distribution Is the probability distribution when the probabilities are equal

In both cases the following rules apply:

1. The probabilities are always between 0-1
2. The sum of all the probabilities is 1

According to the definitions why would adding the sum of 2 dice and graphing the probabilities of the sums not be a binomial distribution?

Now calculate the Experimental Probability from your results, also give your data results to the teacher so that we can calculate the class’s, as a whole, Experimental probability. (Fill in the chart above)

Draw the 2 histograms:

Do you notice anything about the theoretical results and experimental results?

Which is closer to the theoretical, the class as a whole or your individual results?

What do you think is the sample and the population is in the above experiment?

Population: Are all possible measurements or outcomes that are of interest to a specific study of experiment

Sample: is a portion of the population that is selected to represent the population in a specific study or experiment.

So the population would be:

The sample would be:

Well fortunately for you we can use your calculators to do the above experiment the following will explain how:

Calculating probabilities:

1. Obtain the **binompdf** command by pressing: 2nd vars 0
2. Complete the binomial command for the probability of rolling a 6 in 2 trials: 2 , 0.166667 ) enter

You will notice the 2 means the number of trials, 0.166667 is the probability of rolling a 6 in each trial

Try doing the probabilities of:

1. Flipping a heads in 12 trials
2. Having boys in 6 children
3. Rolling 5’s in 14 trials
4. Drawing spades from a deck of cards in 7 trials

When done re-enter the probability of rolling 6 in 2 trails:

Graphing the probabilities:

1. Store the results in list L2: press: store 2nd
2. Clear list L1 by pressing: STAT 1 CLEAR ENTER
3. Now enter: 0,1,2 in list L1

This now represents and looks like our table we created

1. These windows settings are appropriate for this distribution Xmin=0, Xmas=4, Xscl=1, Ymin=-0.1, Ymax=0.8, Yscl=0.1
2. Press 2nd Y= 1 to select Plot 1. On the first line, highlight ON. On the second line select the histogram icon. On the third line enter L1 beside **Xlist**. On the forth line enter L2 beside **Freq**
3. Press GRAPH to produce the graph of the binomial distribution
4. You can press trace and move the cursor to the top of each bar to view the probabilities for each possible outcome.

Does your histogram look like the one we made?

I challenge you know to practice using your calculator and create histograms for the following:

1. Flipping a heads in 12 trials
2. Having boys in 6 children
3. Rolling 5’s in 14 trials
4. Drawing spades from a deck of cards in 7 trials

Draw the histogram that you get and state the population and sample of each:

Population: Population:

Sample: Sample:

Population: Population:

Sample: Sample:

Now I want you to perform the following experiment:

Flip a coin 4 times and record the number of heads you get. Do this 10 times. Fill in the following information:

|  |  |  |  |
| --- | --- | --- | --- |
| Number of heads | Tally | Theoretical Probability | Experimental probability |
| 0 |  |  |  |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |

When you have your information, add it to the information on the board so the class can have the results for later.

Create the histogram for both the theoretical and experimental probability.

When the whole class has given their results record them below and create a histogram

|  |  |
| --- | --- |
| Number of heads | Experimental probability (class) |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

1. Is the above a uniform or binomial distribution:
   1. What is needed to make a distribution binomial?
2. What experiment would create a uniform distribution using coins? (propose an experiment)
3. What is the sample and population of the above experiment?
4. Why do you think we do not use the entire population to do the above experiment?
5. Consider the experiment of rolling two 6-sided dice and recording the sum of the number on the face
   1. List the sample space (or use the one we have from before) and calculate the probability of each sum.
   2. Is this a binomial distribution?(why or why not?)
   3. Draw the histogram of this experiment.
6. A department store is offering customers scratch and save coupons. Of the 15 000 coupons released 1000 win 50% discount, 4000 win a 25% discount and the remainder with 10% discount. Calculate the probability distribution for one coupon
7. The traffic signal at an intersection is programmed so the light is green for 75s, amber for 5s and red for 60s
   1. What is the sample space?
   2. Is this a binomial experiment? If not propose an experiment that would make it a binomial experiment
8. Construct your own Binomial experiment. Write the question, make the sample space and create the histogram