

Binomial Distribution Lab

OPEN SPINNER APPLICATION

APPS → Prob Sim → ENTER → 4 (Spin Spinner)

SET UP SPINNER

1. TABL (graph) → the blank graph disappears & will later become a table
2. SET (zoom) → Change “Sections” to 2 → ENTER
3. ADV (window) → Change the probabilities to what the problem requires. In this case, Section 1 = 0.85. Section 2 should automatically turn into 0.15 after you hit ENTER
 - [Always think of Section 1 as being the probability that your event will happen. Section 2 is the probability that your event will NOT occur. Weights should always be 1.]
4. OK (graph) → OK (graph) → (spinner appears)
5. SPIN (window) → CLEAR (graph) → YES (y=)
6. DON'T TOUCH ANYTHING ELSE!!!
 - You should now have a spinner, a blank table, & the number 1 in a box at the top of the screen. The spinner should be divided into the percents that you entered in the ADV section.

Eric Gordon makes 85% of the free throws that he shoots in a game. We will assume that free throws are independent from one another. Using the calculator's spinner, we are going to simulate many, many, many free throws. Press the +10 (zoom) button. The calculator spins for you 10 times & gives you a chart to show the results. You will need to scroll up & down to see all of the results. Count how many times Eric made a free throw (1). (Remember that the 2's represent the times that he misses.) Write the number of free throws made on the chart for the first set of ten trials. Now press CLEAR (graph) → YES (y=). Repeat the same experiment 20 times. Be sure to count & record the number of free throws made each time!

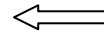
Trial #	1	2	3	4	5	6	7	8	9	10
# of F.T. Made:										

Trial #	11	12	13	14	15	16	17	18	19	20
# of F.T. Made:										

Now that you have recorded your results, exit the probability simulator. Return to NavNet as usual, & press 1 for Activity Center. You should be greeted with a blank chart. Enter the number of free throws made for each of the 20 experiments on separate lines. (If Eric made 9 of the first ten free throws, enter a 9 in the L1(1) row.) Your last entry should occur on line L1(20). When you finish, double-check your list to be sure that all of your entries are correct! Seriously, spend the extra 20 seconds to double-check your typing so you don't screw-up the results. Once everything is correctly entered, press SEND (zoom).

***While waiting for everyone's results to be tallied, answer these questions:

# of F.T. made	# of occurrences	Probability (%)
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		



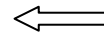
Fill in the chart with the information from YOUR 20 experiments.

What do you notice about the values in the first few rows?

Why do you think the first few rows gave you these answers?

----- S T O P ! WAIT FOR TEACHER -----

# of F.T. made	# of occurrences	Probability (%)
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		



Fill in the chart with the information your teacher gives you from ALL CLASS experiments.

Compare & contrast the results from your experiments versus the results from all of the experiments of the entire class.

Similarities:

Differences:

Which chart is probably closer to the theoretical probability, AND WHY?

Calculate the **theoretical** probability of each event occurring.

# of F.T. made	Probability (%)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Which chart actually came closest to the theoretical probability, yours or the class?

What is the SUM of all of the probabilities in your chart, and why?

What is the probability that Eric makes at least 8 of his free throws?

Now, let's put **you** on the free throw line. Since you have a little less practice than Eric Gordon, you have only a 46% chance of making each free throw. Your favorite math teacher takes you to the gym & gives you ten basketballs to shoot.

Calculate the **theoretical** probability of each event occurring.

# of F.T. made	Probability (%)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Eric just made eight free throws. What is the probability that you make more than he did?

What is the probability that you make at least half of the free throws?

If you graphed the points from each of the two previous charts, what shape would each make if you connect the dots?

Bonus: What is the area between the x-axis & this line for each graph. Why?

Binomial Distribution Lab KEY

OPEN SPINNER APPLICATION

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1. TABL (graph) → the blank graph disappears & will later become a table
2. SET (zoom) → Change “Sections” to 2 → ENTER
3. ADV (window) → Change the probabilities to what the problem requires. In this case, Section 1 = 0.85. Section 2 should automatically turn into 0.15 after you hit ENTER
 - [Always think of Section 1 as being the probability that your event will happen. Section 2 is the probability that your event will NOT occur. Weights should always be 1.]
4. OK (graph) → OK (graph) → (spinner appears)
5. SPIN (window) → CLEAR (graph) → YES (y=)
6. DON'T TOUCH ANYTHING ELSE!!!
 - You should now have a spinner, a blank table, & the number 1 in a box at the top of the screen. The spinner should be divided into the percents that you entered in the ADV section.

Eric Gordon makes 85% of the free throws that he shoots in a game. We will assume that free throws are independent from one another. Using the calculator's spinner, we are going to simulate many, many, many free throws. Press the +10 (zoom) button. The calculator spins for you 10 times & gives you a chart to show the results. You will need to scroll up & down to see all of the results. Count how many times Eric made a free throw (1). (Remember that the 2's represent the times that he misses.) Write the number of free throws made on the chart for the first set of ten trials. Now press CLEAR (graph) → YES (y=). Repeat the same experiment 20 times. Be sure to count & record the number of free throws made each time!

Trial #	1	2	3	4	5	6	7	8	9	10
# of F.T. Made:										

Trial #	11	12	13	14	15	16	17	18	19	20
# of F.T. Made:										

Now that you have recorded your results, exit the probability simulator. Return to NavNet as usual, & press 1 for Activity Center. You should be greeted with a blank chart. Enter the number of free throws made for each of the 20 experiments on separate lines. (If Eric made 9 of the first ten free throws, enter a 9 in the L1(1) row.) Your last entry should occur on line L1(20). When you finish, double-check your list to be sure that all of your entries are correct! Seriously, spend the extra 20 seconds to double-check your typing so you don't screw-up the results. Once everything is correctly entered, press SEND (zoom).

***While waiting for everyone's results to be tallied, answer these questions:

# of F.T. made	# of occurrences	Probability (%)
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

← Fill in the chart with the information from YOUR 20 experiments.

What do you notice about the values in the first few rows?

They rounded to zero.

Why do you think the first few rows gave you these answers?

It is very unlikely that Eric will miss that many shots out of ten because he is such an accurate shooter (has such a high probability of making each free throw).

----- S T O P ! WAIT FOR TEACHER -----

# of F.T. made	# of occurrences	Probability (%)
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

← Fill in the chart with the information your teacher gives you from ALL CLASS experiments.

Compare & contrast the results from your experiments versus the results from all of the experiments of the entire class.

Similarities:

Answers may vary, depending on each student's experiment

Differences:

Answers may vary, depending on each student's experiment

Which chart is probably closer to the theoretical probability, AND WHY?

The class chart is probably closer because many more trials are included. The more trials, the closer the results get to theoretical probability.

Calculate the **theoretical** probability of each event occurring.

# of F.T. made	Probability (%)
0	0%
1	0%
2	0%
3	.01%
4	.12%
5	.85%
6	4.01%
7	12.98%
8	27.59%
9	34.74%
10	19.69%

Which chart actually came closest to the theoretical probability, yours or the class?

Answers may vary, depending on each student's experiment

What is the SUM of all of the probabilities in your chart, and why?

99.99%. It should be 100% because that is the sum of all probabilities. However, because of rounding, our results are .01% too low.

What is the probability that Eric makes at least 8 of his free throws?

$$27.59\% + 34.74\% + 19.69\% = 82.02\%$$

Now, let's put **you** on the free throw line. Since you have a little less practice than Eric Gordon, you have only a 46% chance of making each free throw. Your favorite math teacher takes you to the gym & gives you ten basketballs to shoot.

Calculate the **theoretical** probability of each event occurring.

# of F.T. made	Probability (%)
0	0.21%
1	1.80%
2	6.88%
3	15.64%
4	23.31%
5	23.83%
6	16.92%
7	8.24%
8	2.63%
9	0.50%
10	0.04%

Eric just made eight free throws. What is the probability that you make more than he did?

$$2.63\% + 0.50\% + 0.04\% = 3.17\%$$

What is the probability that you make at least half of the free throws?

$$23.83\% + 16.92\% + 8.24\% + 2.63\% + 0.50\% + 0.04\% = 52.16\%$$

If you graphed the points from each of the two previous charts, what shape would each make if you connect the dots?

Eric's graph makes a steep hill at the right side of the graph.

My graph makes a hill in the center of the graph.

Bonus: What is the area between the x-axis & this line for each graph. Why?

The area is one. Since all probabilities are captured in this graph, their sum should equal one.

TEACHER INSTRUCTIONS

TEACHER

1. Open Navigator
2. Click Activity Center icon
3. Click LIST
4. On the dropdown “contribute” menu, choose LISTS
5. Click CONFIGURE
6. Choose each of the following
 - From independent lists
 - 1 list per student
 - Let students view sequence plots
 - Lists from calculator
7. Click OK
8. WAIT for students to complete student steps #1-7!!!
9. Click START ACTIVITY
10. Click FREQUENCY PLOT
11. Change: Begin=0, End=10
12. Check “Show column count”
13. Change to a normal bar graph instead of one with little people
14. Have students copy final results onto second chart

STUDENTS

1. Log into NavNet
2. press 2ND, QUIT
3. press STAT
4. choose EDIT (1)
5. enter the results from your chart in L₁
6. press APPS & choose NavNet again
7. Choose Activity Center (1)
8. WAIT until all students have completed steps #1-7 & teacher gives the okay
9. Press SEND (zoom) to send this list to the teacher