

The Geometric Die

Name: _____ Block: _____ Date: _____

Question #1: How many rolls do I expect before a one is rolled?
Choose one of the hand simulation methods. Follow the directions to generate data for the individual data chart.

Hand simulation using a die:

1. Roll a die until a 1 appears. Count the number of rolls, including the roll that resulted in a 1.
2. Record your data in the individual chart.
3. Combine class data by recording it in the class data chart.
4. Create a histogram for the class data set. How many rolls, on average, will it take to get a 1?

Hand simulation using a calculator:

1. Use calculator to generate an integer from 1 to 6. Each time an integer is generated counts as a “roll”.
2. Count the number of rolls, including the roll that resulted in a 1.
3. Record and analyze data as stated in method #1.

Hand simulation using a random number table:

1. Turn to a random number table. Look at one digit at a time. If the digit is 0, 7, 8, or 9, ignore it. Otherwise each digit counts as a “roll”.
2. Count the number of rolls, including the roll that resulted in a 1.
3. Record and analyze data as stated in method #1

Individual data chart

Round	Number of rolls
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Class data chart

Number of Rolls	Tally
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

Computer simulation:

1. Open **Jmp-Intro**.
2. Click on **New Data Table**.
3. Double click on **Column** and rename it as **geom** Press enter.
4. Right click on **geom** and choose **Formula...**
5. **Jmp-Intro** has a built-in random number generator that follows the geometric distribution. It returns values from 0 to n , so it is necessary to add 1 to the formula. In the formula box, type **1** and click the + sign. Click on **Random – Random Geometric**. Replace the **p** in the red box with the fraction **1/6** (the probability of getting a “1”). Press enter. Click **OK**.
6. Click on the blue triangle to open the left side of the spreadsheet.
7. Click on the word **Untitled** and rename the worksheet to **geo data**.
8. Click on the red triangle by the worksheet title.
9. Click **New Table Property**.
10. Name it **refresh**.
11. Type **geom<<eval formula** and click **OK**.
12. Click on the red triangle for the rows.
13. Click **Add Rows**.
14. Add as many rows as you want, up to 1000. Click **OK**. **Jmp-Intro** will automatically fill both the row number and the random numbers for the geometric column.
15. Click **Analyze – Distribution**.
16. Click **geom**. Click **Y, Columns**. Click **OK**.
17. You will now have a histogram and boxplot similar to the one below. Notice that there are only a few values of interest: the 5 number summary and the mean. Note also that the mean should be near 6 since that is the expected value for a geometric distribution with probability 1/6.
18. If you wish to generate a new set of data, click on the red triangle by **refresh** and click on **Run Script**. This will generate a new set of numbers that can then be analyzed the same way as before.

Question #2: What is the expected score if my strategy is to sit after 1 roll?

1. Complete the following table of probabilities:

Score	0	2	3	4	5	6
Prob(score)						

2. Calculate the expected score using the formula: $E(\text{score}) = \sum xp(x)$

3. Interpret your result:

Question #3: What is the expected score if my strategy is to sit after 2 rolls?

1. Complete the following table of probabilities:

Score	0	4	5	6	7	8	9	10	11	12
Prob(score)										

2. Why is there a gap in the scores between 0 and 4?

3. Calculate the expected score using the formula: $E(\text{score}) = \sum xp(x)$

4. Interpret your result:

Question #4: What is the expected score if my strategy is to sit after 5 rolls?

Choose one of the hand simulation methods. Follow the directions to generate data for the individual data chart.

Hand simulation using a die:

1. Roll the die 5 times. If a 1 appears in any of the rolls, the score is 0. Otherwise the score is the total of the five rolls.
2. Record your data in the individual chart.
3. Combine class data by recording it in the class data chart.
4. Create a histogram for the class data set. What is the expected score, on average, after 5 rolls.

Hand simulation using a calculator:

1. Set up the calculator to generate 5 integers from 1 to 6. Each list of integers is a "round".
2. If any of the numbers in the roll is a 1, then the score is a zero. Otherwise the score is the sum of the integers in the round.
3. Record and analyze the data as stated in method #1.

11. Right click each of the other columns and copy the formula into the formula box by using control V. Be certain to click OK after each paste.
12. Click on the red triangle for the rows.
13. Click **Add Rows**
14. Add as many rows as you want, up to 1000. Click **OK**. Jmp-Intro will automatically fill both the row number and the random numbers for each of the labeled columns.
15. Name a new column **score**.
16. Right click on the column. Click on **Formula...**
17. Click **Conditional – If**. Click **int1**, type = (which return a double equals sign and outlines a new box in red). Type **1** and press enter. Click on the outside box to outline the entire typing in red.
18. Click **Conditional – Or**. Click **int2**, type =, and press enter. Click on the outside box to outline the everything in red.
19. Repeat until the command looks like: **int1 = = 1 | int2 = = 1 | int3 = = 1 | int4 = = 1 | int5 = = 1**
20. Click in the **then clause** box. Type **0** and press enter.
21. Click in the **else clause** box. Click **int1**, +, **int2**, +, **int3**, +, **int4**, +, **int5**.
22. Click **OK**. The total score is now calculated for each row of data, representing a round of play.
23. Click **Analyze – Distribution**. Click **scores**. Click **Y-Columns**.
24. Click **OK**. You will get a display similar to the one on the next page.
25. In order to run this simulation multiple times easily, click on the red triangle by the worksheet title: simulation.
26. Click **New Table Property**.
27. Name it **refresh**
28. Click in the Value window.
29. Type the following: **int1 << eval formula; int2 << eval formula; int3 << eval formula; int4 << eval formula; int5 << eval formula**
30. Click **OK**.
31. If you wish to generate a new set of data, click on the red triangle by **refresh** and click on **Run Script**. This will generate a new set of numbers that can be analyzed in the same manner as before. Since the exact values were not calculated (given) for this strategy, it is important to generate several sets of data to determine a better approximation for the mean score for this strategy.

BONUS: Modify the directions so that you use the computer and Jmp-Intro to simulate the strategy: sit after 10 rolls.