The Dice Have Spoken: An Analysis of Probability and the Mysteries of Randomness

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Abstract

This experiment aimed to investigate the probability of rolling a pair of dice and analyze the outcomes. A pair of standard six-sided dice was used in the experiment, and the results of each roll were recorded. The experiment was conducted by rolling two six sided dice a total of 100 times, and the outcomes were analyzed and stored in Google Sheets so we could better understand dice probability with different types of charts. The results of the experiment showed that out of 100 rolls of a pair of dice, the most number of outcomes was seven.

Introduction

Stephen Hawking, an English theoretical physicist, once said, "The science of probabilities and statistics is essential in forming judgments and making decisions in the face of uncertainty." What is probability, and why is it so important? Probability is the chance for something to occur. Like the probability of you drawing a certain card from a deck of cards. This is important because we use probability all the time in our everyday lives. From whether to take an umbrella outside all the way to gambling. In this lab report, we will find the answer to what is the most probable dice outcome of 100 rolls of two six sided dice. My hypothesis is that seven will be the most common sum because seven has the most combinations that could add up to its own sum on 2 six sided dice.

Materials

1. Two Dice
2. A Google Excel Sheet
3. Pen and paper

Methods

In this experiment, I used two six sided dice from an old Monopoly board game set. Now that I had the most important material in the experiment, I rolled the two dice 100 times and recorded them on my Google Sheet. I directly inputted the data into the Excel sheet because I could in the future use the cool features of chart making in Google Sheets. After that, I used a small amount in Google Sheets that would count every time a certain number popped up in the sum column. This new column made by the code will be called "Number of Outcomes". I used this code for every sum that could be made with two dice. The sums would be any number

between 2 and 12. With all this data, the last thing to do is to make a graph to better illustrate the results.

Results

In figure 1, I made a column chart to better illustrate how seven is the highest probability dice sum of two dice with a 19 percent probability. While in Figure 2, I made a data table to show the precise number of outcomes each sum had.

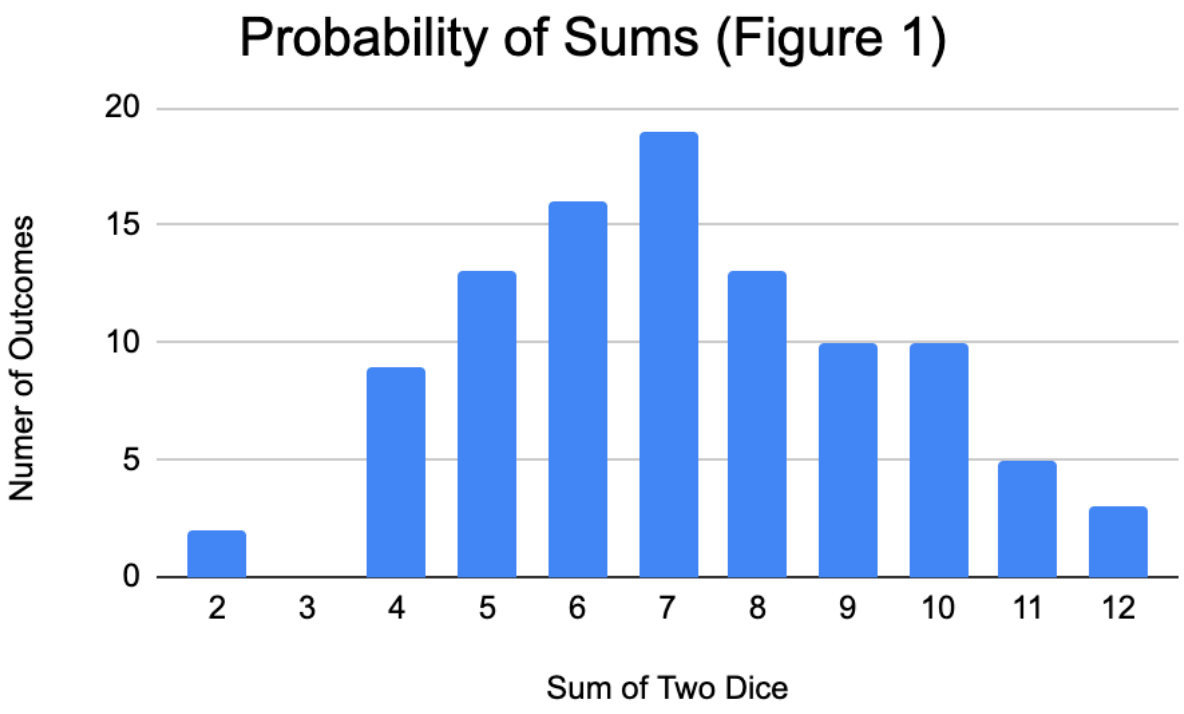

Figure 1: A probability of sums column chart

Sums	Number of Outcomes
2	2
3	0
4	9
5	13
6	16
7	19
8	13
9	10

10	10
11	5
12	3

Analysis

As I said in my hypothesis, I believed the number seven would lead to the highest number of outcomes because 2 six sided dice have the highest possible combination of seven as an outcome. As shown below in Figure 3, you have ⅙ chance of getting a seven. This 0.167 probability is the highest probability. That is why my results in Figure 1 look very similar to the results in Figure 3. Both figures have this hilly look to them. However, I was surprised that there wasn't a single outcome of three out of 100 rolls. This is very bizarre to me because I thought that Figure 1 would not look so steep but a little bit linear with less of a gap between the number of outcomes.

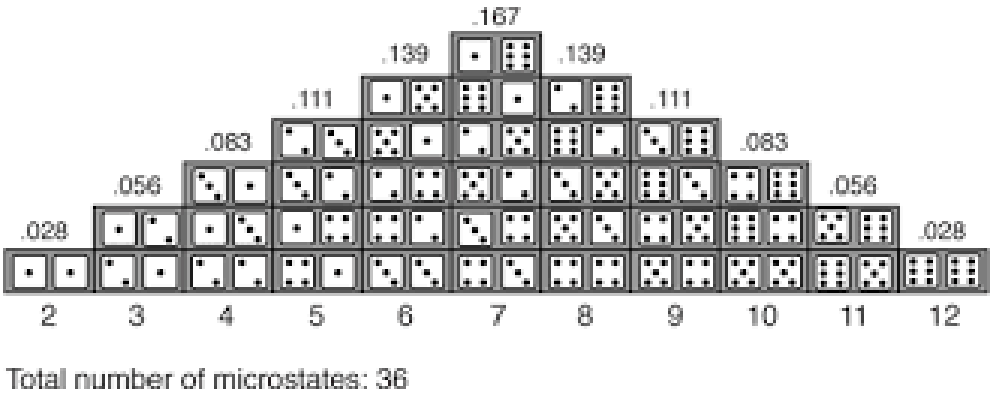

Figure 3: Possible outcomes of a two dice roll.

Another study done by Stanislav Lukac and Radovan Engel conducted an experiment that is very similar to the one that I did. However, instead of using two dice in their experiment, they used three. However, the experiment led to the same conclusion: that the probability of a certain number increasing when that number has more combinations to add up to it. "Galileo Galilei was

interested in the sums of the scores on the dice and explained why the sum 10 occurs more frequently than the sum 9 when rolling the three dice. There are more possibilities for the sum 10 than for the sum 9 and this is the reason why the sum 10 occurs more frequently than the sum 9." Figure 4 shows the results of the other experiment that uses three dice. Figure 1 shows the results of my experiment. These two column charts both look very similar and both have one number that has the most outcomes. This is because these numbers have the most possible combinations of sums.

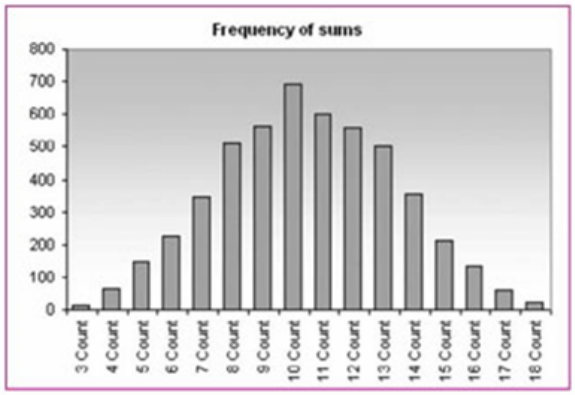

Figure 4: Lukac and Engel experiment

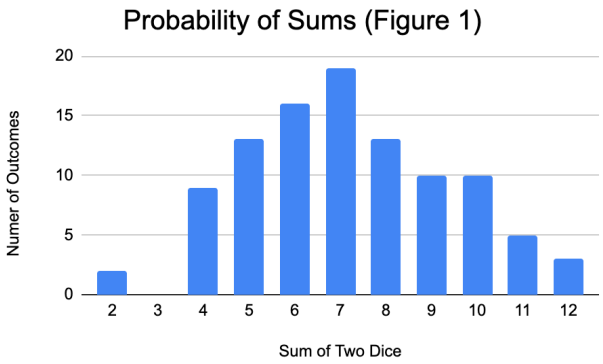

Figure 1: Introduced in page three

Conclusion

This experiment proves why people use the term lucky seven. As I stated in the beginning of the experiment, seven would most likely have the most number of outcomes due to having the most dice outcomes equal to it, as shown in Figure 3. However, I was not expecting there to be zero outcomes for the sum of three, even though there were 100 rolls. Some other variations of this experiment that we can do are changing how many rolls we do and how many dice are rolled at the same time. With these other variations of the experiment, we can analyze their similarities and differences. This is interesting because now we understand what dice probability is and how

it works. We can apply this knowledge to anything that involves dice. From gambling to board games. From now on, I'll know what properties to buy in Monopoly.

Reference

Lukac, S., & Engel, R. (2010). Investigation of probability distributions using dice rolling simulation. Australian Mathematics Teacher, 66(2), 30+. https://link-gale-com.ccny-proxy1.libr.ccny.cuny.edu/apps/doc/A229718040/AONE?u=cuny_ccny&sid=bookmark-AONE&xid=ef400cc7

Appendix

Data table used for making charts.

dice1	dice2	sum	Number of Outcomes	Sums
4	6	10	2	2
6	3	9	0	3
1	6	7	9	4
3	3	6	13	5
2	3	5	16	6
3	4	7	19	7
3	2	5	13	8
3	6	9	10	9
5	2	7	10	10
4	6	10	5	11
3	5	8	3	12
5	3	8		
3	2	5		
3	2	5		
3	2	5		

5	2	7		
6	3	9		
5	1	6		
6	1	7		
2	4	6		
1	3	4		
4	4	8		
6	1	7		
4	6	10		
3	4	7		
3	5	8		
2	4	6		
1	6	7		
1	4	4		
4	1	5		
6	1	7		
3	3	6		
5	5	10		
3	5	8		
3	1	4		
4	3	7		
3	2	5		
2	5	7		
6	5	11		
1	5	6		
6	4	10		
3	2	5		
6	4	10		
5	2	7		
4	2	6		
3	4	7		
6	3	9		
6	2	8		

3	3	6		
5	2	7		
2	6	8		
2	1	36		
1	5	6		
6	6	12		
1	4	5		
4	5	9		
2	2	4		
4	4	8		
5	5	10		
4	3	7		
1	3	4		
5	6	11		
4	1	5		
3	3	6		
6	2	8		
5	4	9		
3	2	5		
2	6	8		
4	3	7		
3	1	4		
3	1	4		
4	6	10		
3	3	6		
3	5	8		
4	1	5		
4	5	9		
4	3	7		
4	6	10		
6	4	10		
6	6	12		
2	4	6		

1	3	4		
5	4	9		
1	5	6		
3	4	7		
2	3	5		
3	3	6		
5	6	11		
6	5	11		
6	3	9		
1	1	2		
6	2	8		
2	2	4		
5	6	11		
6	6	12		
4	5	9		
5	1	6		
1	6	7		
3	3	6		
2	6	8		
1	1	2		