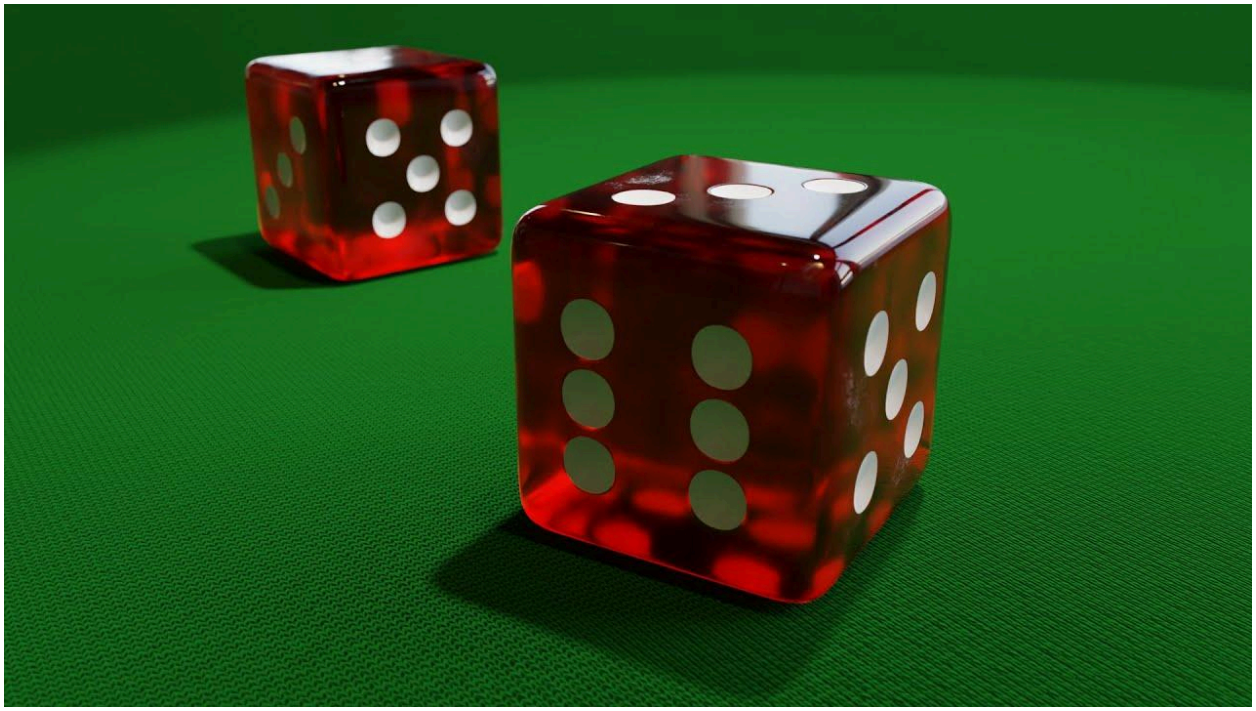
Lucky Die:

A Study of the Probability of Dice Rolls



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Abstract

In this study the focus was on the frequency of certain sums as a result of random dice rolls. Using python, a program was built in order to replicate the random chance of a potential dice roll. Using said program it was determined that across the range of possible sums, the values that are the most extreme were the ones with the lowest frequency. Comparatively the values that were the closest to the average had higher frequencies. As a result it could be argued that one is significantly more likely to get a number in the middle of the range 2 to 12 compared to getting 2 or 12.

Introduction

The definition of the word random is something happening by chance rather than in accordance with a plan. This concept is best illustrated by dice which, through its ubiquity across cultures, works as a frame of reference for this concept. Every time we throw a die we agree to the notion that we have no real control over the result we get. But do we truly have zero control, or is there a way to predict the probability of a dice roll outcome? This is the question that will be tested within this lab report. As a result of this test it is expected that when rolling 2 dice and adding the results together, there will be a difference in the number of times a sum is reached depending on how many dice combinations can output said number, with numbers that can be output from more dice combinations appearing much more frequently than ones that are output from fewer dice combinations which as a result will lead to the smallest and highest possible sums to have the lowest frequency of outputs.

Materials and Methods

- A computer
- Python 3.5
- Google Sheets

1. In Python 3.5 a program was built that would pick a number between 1 and 6 randomly 100 times to simulate a dice roll
2. The program would be run twice in order to recreate the experience of rolling two dice.
3. The results were imported into Google Sheets where it would then be organized into a table with a column for the first roll, second roll and the total.

4. Said table would then be organized into a graph that would display the most frequently occurring sums for the sake of analysis

Results

After generating the dice rolls using Python, the results were then compiled into charts for further analysis.

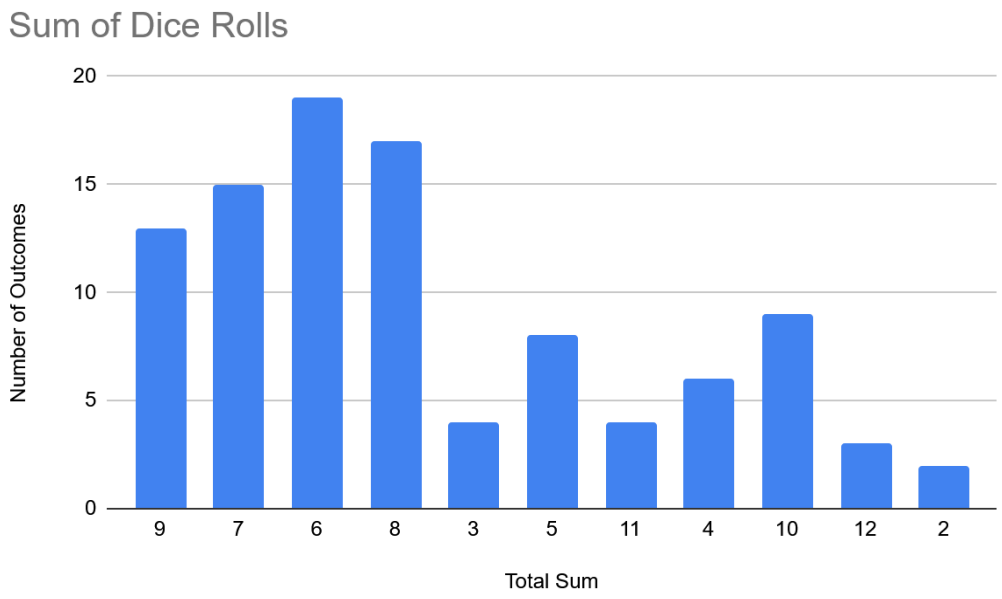

Figure 1 - Bar graph representing the number of times a sum was reached

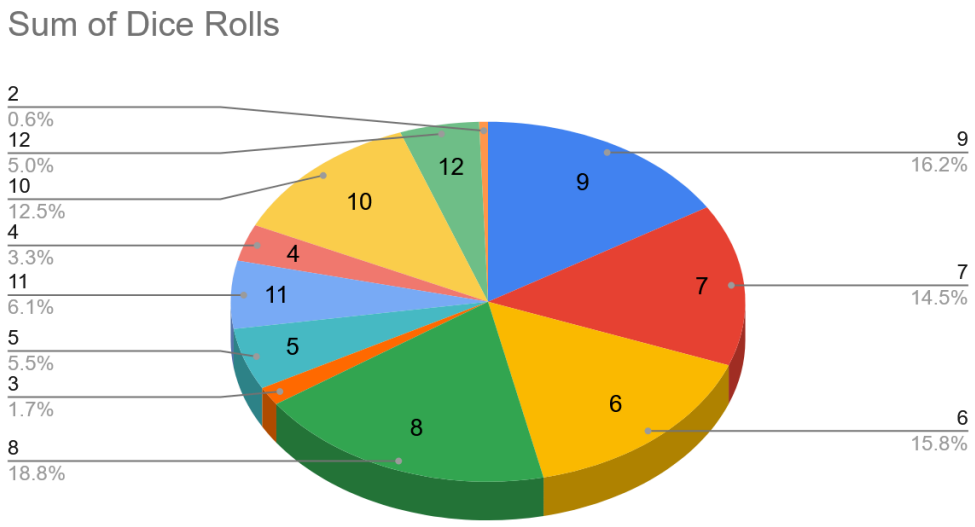

Figure 2: a pie chart detailing every sum reached and the percentage of dice rolls that reached it.

Analysis

Based on the results, it seems that the hypothesis outlined earlier may be correct. According to the data, some of the least received sums include 2 at 0.6% and 12 at 5%, the former of which can only be received via both dice displaying one and the latter by said dice both displaying6. On the other hand, the most common outcomes were dice rolls adding up to 8, 9, and 6. Compared to the sums listed formerly, the more frequently occurring sums tend to be the result of more dice pairs, such as six which can be reached by a roll of 2 and 4, 1 and 5, and 3 and 3. Because of this six has triple the chance of being picked compared to numbers like twelve and two. As such these findings lend credence to the claim that the sums with the least amount of possible factors are less likely to be an outcome compared to sums with far more possible dice pairs.

While not the same experiment, the study “Investigation of probability distributions using dice rolling simulation” by Stanislav Lukac & Radovan Engel also studied the probability of dice. While they had notable differences such as using three dice and conducting the experiment in Microsoft Excel rather than Python, they came to conclusions similar to the one outlined in this report. Said results were that the lowest and highest possible sums ended up being the least likely results to show up. In their case, the sums with the lowest frequency were 3 and 18 while the sums with the highest frequency were 10 and 11. Furthermore, this experiment conducted more trials than this one, 5000 compared to this experiment's 100 trials. As such the conclusion came to by the data is most likely correct.

Conclusion

Dice rolling has been a common action that people have performed for a significant amount of history. Due to this testing, the probability aspect of dice rolls becomes an intriguing subject of study for many, leading to the creation of this report. From this test specifically, it was determined that the more extreme in value a sum is, the less frequently it will be rolled for. However there are aspects of this that could be improved, This test only did 100 trials which could be increased for even more accurate results. Furthermore, the test used a computer to generate the results which creates an ideal scenario where factors like the strength of the throw had no bearing on the result. This opens the door for a recreation of this experiment but with real-life trials to test whether these results will show up in a real-world scenario. Nevertheless, as a result of these studies, one will be more informed in how likely their odds are for rolling a certain number on a pair of dice, whether for fun or other needs.

Work Cited

Lukac, S., & Engel, R. (2010). Investigation of probability distributions using dice rolling simulation. *Australian Mathematics Teacher*, *66*(2), 30–35.

Appendix

The code used to generate the dice rolls was made in Python 3.5 and is printed below

```
import random
i = 1
while i <= 100:
    dice_roll = random.randrange(1,7,1)
    print(dice_roll)
    i += 1
```