Name(s)

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Project Number

S1207

Project Title

Law and Order: Benford's and Zipf's Laws

Abstract

Objectives/Goals

The purpose of this project was to test Benford#s Law and Zipf#s Law, two mathematical laws, to see if they actually work. Also, this experiment was to test if certain seemingly random numbers are in fact not random. My hypothesis is that certain seemingly random lists of numbers are, in fact, not random, and will follow Benford's Law and Zipf's Law. Furthermore, if one number list follows one of the laws, it will also follow the other law.

Methods/Materials

Using ranked lists found on the Internet, count how many of the numbers begin with 1, 2, 3, etc. and record. Find the percentage of the total numbers that begin with 1, 2, 3, etc., record, and compare to Benford#s Law. Then, decide whether the list of numbers follows Benford#s Law. Using the same lists, find the numbers according to Zipf#s Law (the first stays the same, the second number is ½ of the first number, the third number is 1/3 of the first number, the fourth number is ¼ of the fourth number, etc.) and record. Compare the real numbers to the numbers created by Zipf#s Law and decide whether the ranked list follows Zipf#s Law.

Results

Only Chart #5 (227 Countries Ranked by Population) and Chart #6 (Top 100 Languages by Population Chart) followed Benford#s Law. Only Chart #6 followed Zipf#s Law. Chart #5 followed Zipf#s Law for about the first 50 numbers before becoming too inaccurate.

Conclusions/Discussion

Though some of the other lists did have the characteristics of a set of numbers that should follow Benford's Law, there were not enough items on the list for the law to show itself. In other words, one should use lists of numbers that are long enough to allow Benford#s Law to emerge. Also, because Chart #5 only followed Zipf's Law for about the first 50 numbers it shows that Zipf#s Law needs modification to work correctly. It also proves that numbers do not have to follow one law in order to follow the other.

Summary Statement

The purposed of this project was to test Benford's Law and Zipf's Law, two mathematical laws, to see if they actually work, and to see if certain seeminly random lists of numbers are truly random.

Help Received