What is a Random Event? A Project for Finite Math or Statistics

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Abstract: Randomization is an important idea in Finite Mathematics and Statistics. One main idea in these courses is that events that appear to be performed in a random fashion are often not random. Here we present a simple project involving "randomly" opening the Bible. This activity leads to deeper philosophical questions such as how to study the Bible and whether an event can be considered random if God intervenes.

Introduction

Martha Burkhalter told the following story about the courtship of my great-great grandparents, Mary Lugibihl and Peter Burkhalter.

> Mother had a meager education and went to school only a few years. She had to work hard during her childhood days and often missed the loving care of a mother and a father. She was always cheerful, however, and had many friends. On August 5, 1875, at the age of 22, she came to Adams Co., Indiana in a wagon. Mother and father met each other for the first time at grandfather Stauffer's home. But the romance did not begin until they met again at the home of Abraham Sprunger, where mother was working as a hired girl at that time. One day Father came to sell a sheep to Abraham Sprunger. He tells the story that Mother was hanging up clothes and they had a short conversation before he left. That Saturday night he came to see her. Before he left they took the Bible and chose a Psalm. The Bible opened to Psalm 45 for both of them. The Psalm helped them decide right then to be life companions.

Peter and Mary were married a year later.

Christian lore contains many such stories of people opening the Bible at random for direction. For example, the 1941 movie *Sergeant York* shows the wind blowing the Bible open to Matthew 22:21 thereby convincing Alvin York (Gary Cooper) to put aside his pacifist beliefs and fight in World War I. It seems that these stories are sort of a statistical inference test—a result is too unlikely to happen by chance alone and therefore must be a sign from God.

If we did a significance test on Mary and Peter's selection of Psalm 45, what probability would we assign? If we assume that each of the 150 Psalms was equally likely to be selected, the probability that both Bibles would open to Psalm 45 would be $\frac{1}{150}\cdot\frac{1}{150}\approx.000044$. The probability that both Bibles opened to the same Psalm would be $\frac{150}{150}\cdot\frac{1}{150}\approx.0067$.

Yet, our assignment of probability would have to take into account how the "random" selection was made. Unless the two picked a number between 1 and 150, not all Psalms were equally likely of being selected since Psalm 117 has only two verses while Psalm 119 has 176. Furthermore, perhaps Peter and Mary were biased in their selections. While Psalm 45 is lesser known, the New American Standard Bible titles it as "A Song Celebrating the King's Marriage."

The Project

Probability is an elegant and powerful topic but it is difficult conceptually. In order to provide motivation and to introduce some of its subtleties, I have used a group project in my Finite Math course that involves computing probabilities by randomly selecting passages in the Bible.

I provide the following chart in order to compute probabilities using the classical, or theoretical, perspective of probability.

	Old Testament	New Testament	Total
Books	39	27	66
Chapters	929	260	1189
Verses	23,214	7,959	31,173
Words	593,493	181,253	774,746
Letters	2,728,100	838,380	3,566,480

King James Version

For the relative frequency view of probability, each group uses a random number generator on their calculator to find 100 passages in the Bible. The group records the page number, the Testament, the book, and the chapter. To add more interest, I instruct them to excerpt a "meaningful" verse and an "interesting" verse from that chapter. By "interesting" I mean a verse like Hosea 1:2 that begins with the instructions to "Go and marry a prostitute."

The students then compute various probabilities and compare the results of the classical perspective with the relative frequency perspective. For example, what is the probability of selecting a passage in the New Testament using the number of books in the Bible? Number of chapters? Verses? Words? Letters? Estimate the probability from the empirical results and compare the probabilities.

The project then instructs the students to find a well-worn Bible and randomly flip it open 25 times. The students tabulate their results as they did when they used a random number generator. They are to comment on why the results might be different.

Finally, students are asked to find an "expert" to comment on the usefulness of this approach in devotional study.

Intended Learning Outcomes

The project's main focus is to communicate that events that appear to be performed in a random fashion are often not. One motivation for the project came from the (perhaps apocryphal) experiment of testing children's vocabulary. Researchers tested the number of words children knew by opening the dictionary and pointing to a word on the page. It was surprising that the children had a much higher rate than expected until it was realized that common words had longer definitions and were therefore more likely to be selected.

Flipping open the Bible is probably not very random. It might be biased towards the middle sections or towards where it is worn. To emphasize this point, the project contains a tongue-in-cheek guide to where the Bible should open.

Dr. T. H. Horne	Acts 26 ("the finest piece of reading in the entire Bible.")
Martin Luther	Romans 8
Pentecostal	Acts 2
Seventh Day Adventist	Exodus 20
Mennonite	Matthew 5
Liberal	Luke 15
Dispensationalist	I Thess 4:17 or any verse in Revelation after chapter 3
The "World"	Matthew 7:1 (It may just be the most quoted verse.)
Calvinist	Ephesians 1:11
Nazarene	I Peter 1:16

(Dr. T.H. Horne was a 19th century biblical scholar who did several statistical studies of the Bible.)

Another objective of the project is to stress the necessity of examining assumptions. For example, how one defines the sample space will affect the experiment. For instance, the probability of selecting a New Testament passage using the books of the Bible is $27/66 \approx 0.409$ while using the number of chapters lowers the probability to $260/1189 \approx 0.219$. While most immediately recognize that different translations will have a different number of words and letters, some need to be reminded of the variation in verses due to disputed verses in the Bible such as Mark 6:19 ff, John 5:4, or John 7:53-8:11.

Furthermore, what assumptions should the students make about how they flipped opened the Bible? Can it be considered random? In an effort to be random, perhaps some overcompensated. Perhaps some were tempted to fit the data to the experiment. Similarly, if someone were intent using this method to gain guidance, might he or she subconsciously select certain passages, the New Testament for example, to gain a desirable answer?

One of the benefits to the project is that it interests my students. Cards, dice, and gambling are useful pedagogical tools in teaching probability, but not all students are familiar with them. As illustrated to me at a museum exhibit on children's games, the trend is for children's games to rely on computer simulation rather than on dice or cards. Still, I continue to use cards and dice but try to minimize gambling illustrations. While gambling may provide great motivation, (some instructors use the students' own money when discussing significance tests), gambling is hard for me to redeem morally. Furthermore, my institution prohibits it.

Spiritual considerations

While there are mathematical lessons with this project, there are spiritual implications as well. Is this an appropriate use of the Bible? Each group is asked to find an "expert" to comment on the usefulness of opening the bible at random. The group then discusses the approach, writes a summary of the expert's thoughts, the members' personal thoughts, and any conclusions to be made.

The responses during the class discussion varied. Many of the experts thought that it was a lazy approach to studying the Bible, and that it came close to making God into a genie. Others suggested it may work occasionally in the short-term but is inappropriate as a long-term approach. Someone suggested that only with a solid understanding of the Bible and its symbolism could one interpret appropriately a "potshot" answer.

One novel approach that I mention to the class is the one taken by Donald Knuth in his book *3:16*. Knuth selected the 16th verse after the 3rd chapter for 59 of the 66 books of the Bible. He used historical and spiritual insights to each of the verses as an introduction to that particular book of the Bible.

There are other possible discussions that are related to probability. Is anything we do random if God intervenes? How does the idea of randomness relate to the debates over free will and determinism? Is God bound by the laws of probability? Is it appropriate to use a statistical test on God? What should be made of the randomized, controlled trials on the effectiveness of prayer on hospital patients?

Conclusion

Overall, I was very pleased with the results of the project. The students were engaged in active learning, and they appeared to have a better understanding of statistical randomness afterwards. The project illustrated the importance of examining assumptions and defining the sample space. However, my biggest satisfaction was that many students confronted issues related to how to study the Bible.

References

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Knuth, Donald *3:16*. Madison, Wisconsin: A-R Editions, Inc., 1991.

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