

Outline: Applications of Finite Mathematics

Taylor Dupuy

January 17, 2023

The primary book for the course is Tannenbaum's *Excursions of Finite Mathematics*. This book is a little dry so I'm going to supplement with stories of my own and many of which I've borrowed from the book *How Not To Be Wrong* by Jordan Ellenberg (you don't need this book for the course).

1. Counting and Probability

- (a) *Cash WinFall* aka *Jerry and Marge Go Large* aka The MIT Lottery Kids.
- (b) Cointossing and the Birthday Problem.
- (c) How the Allies Calculated the Number of German Tanks in World War 2.
- (d) *Let's Make a Deal* and The Monty Hall Problem.
- (e) Utility Functions: why if you never miss a plane you are probably doing it wrong.

Because the exposition on counting and probabilities is a little weak, I will supplement with Part I of *The Magic of Mathematics* by Gross and Harris which covers the material in Chapter Also, the order is not the greatest and it misses a lot of great opportunities to tell wonderful stories.

2. Statistics

- (a) Fishy p -values.
- (b) Biased Sampling: Berkson's Fallacy, Survivor Bias and the Baltimore Stock Broker.
- (c) Correlation, Causation, and Logical Problems.
- (d) Everyone wants to make everything a line, but everything isn't a line (regression and the Laffer curve).

3. Graphs and Networks

- (a) The Seven Bridges of Königsburg Puzzle [and the House Walking Puzzle].
- (b) The Traveling Salesman Problem
- (c) The Three Houses and Three Utilities Puzzle.

4. Voting

- (a) Slime Molds and Burlington's 2009 Mayoral Election.

5. Symmetry and the Golden Ratio

- (a) The Prisoner Puzzle: <https://www.youtube.com/watch?v=hYSaEyPK5MQ>
- (b) The Hummer Shuffle: <https://web.northeastern.edu/seigen/11Magic/Hummer/Hummer.html>
- (c) The Golden Ratio