Discrete Structures: Probability

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Introduction

A song
  https://www.youtube.com/watch?v=au8hf0-A27s

Likelihood
  https://www.youtube.com/watch?v=QpfMwA0z_1Y
Simple Demonstrating Examples

Probability and counting: guessing in T/F exams
  https://www.youtube.com/watch?v=3V2omKRX9gc

A problem with three methods to solve it
  https://youtu.be/fyv1i2YbNt0

A dice problem
  https://www.youtube.com/watch?v=Kgudt4PXs28&feature=youtu.be

Dice Example: Independence addition and complement
  https://www.youtube.com/watch?v=dqNvtYWmSrY&list=PL482E6C6B5F0A30E7&index=7&t=0s

Marble Example: addition vs. multiplication
  https://www.youtube.com/watch?v=lA7rprQecV8&list=PL482E6C6B5F0A30E7&index=6&t=0s
Law of Large Numbers & Probabilities via Simulations

Introducing the concept
- https://www.youtube.com/watch?v=MntX3zWNeC

Experimental versus theoretical probability
- https://www.youtube.com/watch?v=Nos-xOCpQgg&feature=youtu.be

Collecting six coupons via simulations
- https://www.youtube.com/watch?v=2AVLfSRpmfg&feature=youtu.be
Conditional Probability

The formula for two events with a proof by example

https://www.youtube.com/watch?v=H02B3aMNKzE&list=PL482E6C6B5F0A30E7&index=2&t=0s

Statistics example: independence and conditional probability

https://youtu.be/pIfpHdGVwLU

Coin example: conditional probability

https://youtu.be/Zxm4Xxvzohk

Conditional probability via false positive and false negative

https://youtu.be/hxEdXUB_IdQ
Two Children One of Them is a Boy Like Problems

The Original Problem
- [https://www.youtube.com/watch?v=MDzbD2Ay5b4](https://www.youtube.com/watch?v=MDzbD2Ay5b4)

Variations
- Three red-blue cards: [https://www.youtube.com/watch?v=1IFM1ngwEb0](https://www.youtube.com/watch?v=1IFM1ngwEb0)
- 2 Aces and 2 twos: [https://www.youtube.com/watch?v=TGukPgViEkg](https://www.youtube.com/watch?v=TGukPgViEkg)
- A dice version: [https://www.youtube.com/watch?v=lTJydnfGyyk](https://www.youtube.com/watch?v=lTJydnfGyyk)

The Frogs Story
- Wrong: [https://www.youtube.com/watch?v=cpwSGsb-rTs&vl=en](https://www.youtube.com/watch?v=cpwSGsb-rTs&vl=en)
- Correct: [https://www.youtube.com/watch?v=g03xtDdsNQM](https://www.youtube.com/watch?v=g03xtDdsNQM)
Biases in Statistics

- Examples of bias in surveys
  
  sampling-observational-studies/v/examples-of-bias-in-surveys

- Example of undercoverage introducing bias
  
  sampling-observational-studies/v/example-of-under-coverage-introducing-bias

- Sources of Bias
  
  https://www.youtube.com/watch?v=j8sOuCo0ybY

Application

- Why do airlines sell too many tickets?
  
  https://youtu.be/ZFNstNKgEDI
Intuition Or Not?

Monty Hall

- https://youtu.be/_X5erR9LKUs
- https://youtu.be/4Lb-6rxZxx0

The birthday “paradox”

- https://youtu.be/KtT_cgMzHx8

The false positive “paradox”

- https://youtu.be/1csFTDXXULY
Problems With “Counter Intuitive” Answers

Relatively Easier Problems

- Random walkers meeting on a grid
  - https://www.youtube.com/watch?v=F_kt51Qj1RI
- Guessing randomly on A matching test
  - https://www.youtube.com/watch?v=h2VMMlpEtRU

Relatively Harder Problems

- What is the chance twin brothers are identical?
  - https://www.youtube.com/watch?v=xBPMoavS5Hs
- HH needs 6 and HT needs 4 flips via markov chains
  - https://www.youtube.com/watch?v=IAiNqQi30-Y
  - https://www.youtube.com/watch?v=--mxW3jDlGk
- Conditional probability with boys and girls
  - https://www.youtube.com/watch?v=UQnBGmlaLjY
Paradoxes

The Simpson’s paradox

- https://youtu.be/sxYrzzy3cq8
- https://www.youtube.com/watch?v=ebEkn-BiW5k
- https://www.youtube.com/watch?v=E_ME4P9fQbo&vl=en
- https://www.youtube.com/watch?v=cOQFSmj1jv0
- https://www.youtube.com/watch?v=ZDinnCwP3dg

Bertrand’s paradox

- https://youtu.be/xy6xEhbGa0
Beyond Basic Probability

Fermet needs 2 wins Euler needs 3 wins

https://www.youtube.com/watch?v=C_nV3cVkJog

Weird dice with the same distribution

https://www.youtube.com/watch?v=kG4Fh_PrN-E

The reason casinos always win meet the law of large numbers

https://www.youtube.com/watch?v=RXY-WN0ahiw

An alien extinction riddle

https://www.youtube.com/watch?v=A5-Q2GdD5xw