Stat 88 lec 1

Today

1. Course resources
   a) Course website

      http://stat88.org

   b) Pre-lecture notes on b-courses/pages

      https://bcourses.berkeley.edu/courses/1489056

   c) Piazza

      https://piazza.com/class/k5k20py3wbjha

   d) gradescope

      https://www.gradescope.com/courses/83496

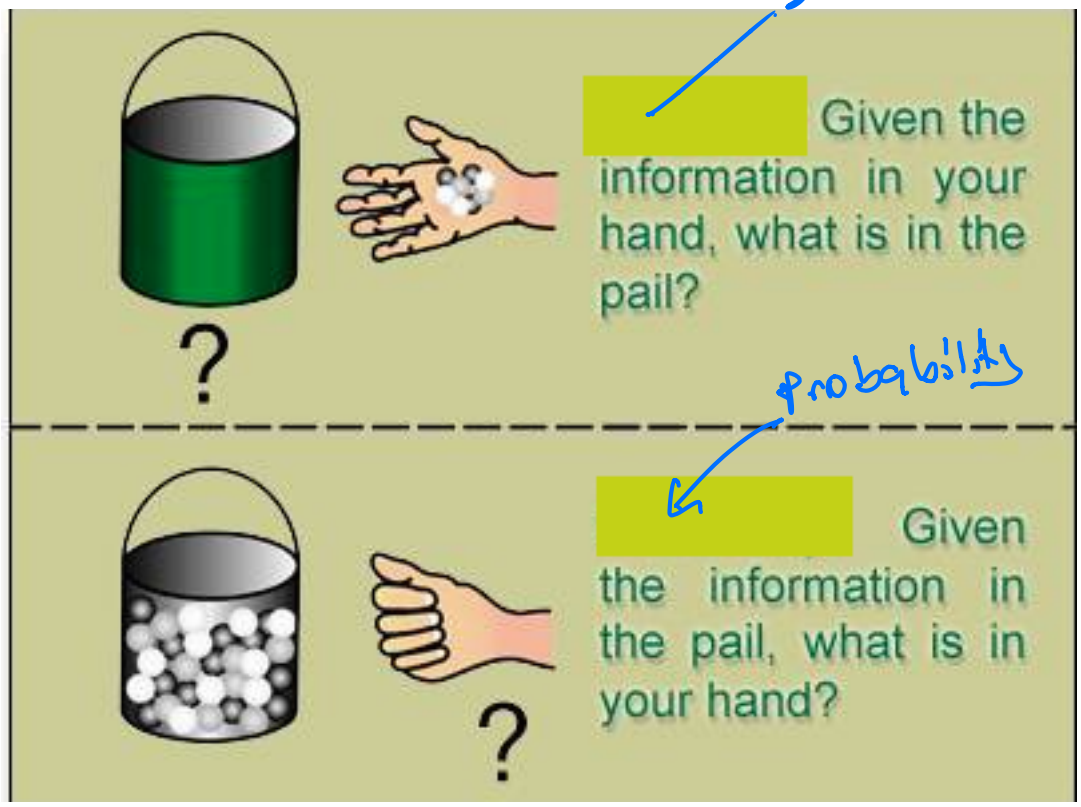
2. ice-breaker

3. a) Sec 1.1 Probability as proportion
   b) Sec 1.2 Exact Calculation or Bounds

1) icebreaker

Introduce yourself to your neighbor

Discuss which is probability and which is statistics:



Example of probability!

If you draw 5 cards from a well shuffled deck, what is the chance you get 4 of a kind, Here the deck is your population and your poker hand is the sample.

Sec 1.1 Probability as proportions

Probability is a numerical measure of uncertainty.

equally likely outcomes:

We call the set of all outcomes of an experiment Ω, the outcome space or the sample space

let $A \subseteq \Omega$ event

$$P(A) = \frac{\#A}{\#\Omega}$$

ex what is chance that a die shows a multiple of 3.

$\Omega = \{1, 2, 3, 4, 5, 6\}$

$A = \{3, 6\}$

$$P(A) = \frac{\#A}{\#\Omega} = \frac{2}{6} = \frac{1}{3}$$

Deck of cards:

4 suits S, H, C, D

13 ranks Ace, 2-10, J, Q, K

52 cards

ex

Suppose a deck of cards is shuffled and the top 2 cards are dealt. What is the chance you get at least one ace among the 2 cards

i.e. $A = \{(\text{ace},\text{ace}), (\text{ace},\text{nonace}), (\text{nonace},\text{ace})\}$?

(4, 3) (4, 48) (48, 4)

$\#A = 4\cdot 3 + 4\cdot 48 + 48\cdot 4$

$\#\Omega = 52\cdot 51$

$P(A) = \frac{\#A}{\#\Omega} = \frac{4\cdot 3 + 4\cdot 48 + 48\cdot 4}{52\cdot 51} = .149$

Alternate solution

A^c ← complement of A (event neither card is an ace)

$A^c = \{(\text{nonace}, \text{nonace})\}$ $\#A^c = 48\cdot 47$

(48, 47)

Ω = any pair of cards = {(any card, any other card)} $\#\Omega = 52\cdot 51$

(52, 51)

$P(A) = 1 - P(A^c) = 1 - \frac{48\cdot 47}{52\cdot 51} = .149$

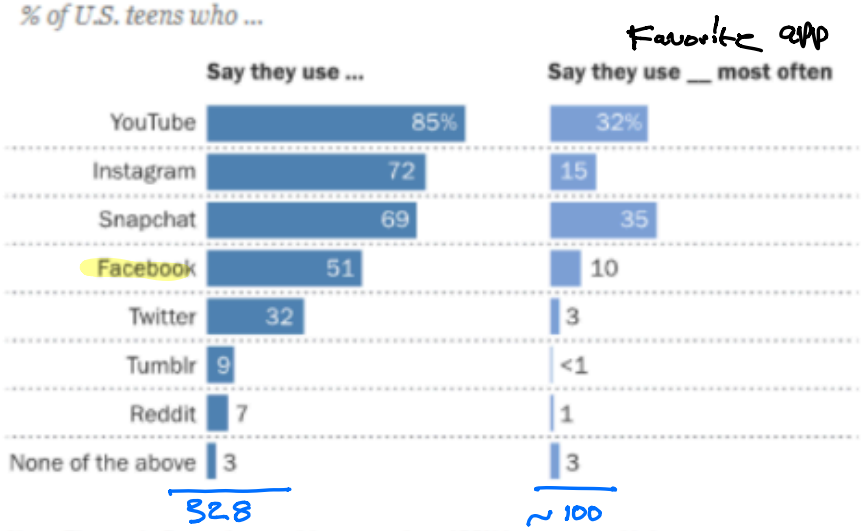
not equally likely outcomes

Ex we wish to understand student usage of FB.

Data

YouTube, Instagram and Snapchat are the most popular online platforms among teens

% of U.S. teens who ...



Note: Figures in first column add to more than 100% because multiple responses were allowed. Question about most-used site was asked only of respondents who use multiple sites; results have been recalculated to include those who use only one site. Respondents who did not give an answer are not shown.
Source: Survey conducted March 7-April 10, 2018.
"Teens, Social Media & Technology 2018"

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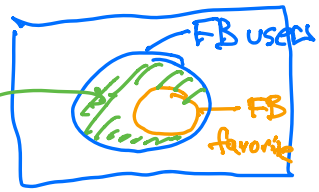
the second is but the first isn't since it adds up to more than 100.

Are these columns distributions?

Why can % add up to more than 100% in first column? ↳ a teen can choose more than one answer.

What is chance a randomly chosen teen doesn't use FB most often? ~ 100 − 10 = 90%

Chance student uses FB but not favourite

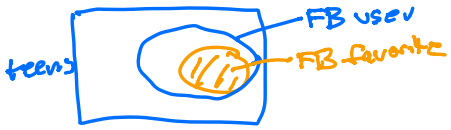


this area is chance a FB user isn't a FB favorite.

51 − 10 = 41%

Is the chance a randomly selected FB user uses FB most often > 10% or < 10% ?

Visually the proportion of FB favorites inside FB users is larger than the proportion of FB favorites inside of all teens!



Calculate the % exactly

Chance FB favorite given FB user $= P(\text{FB fav} \mid \text{FB user}) = \frac{10}{51} = .2$

$P(\text{FB user}, \text{FB fav})$ ↙

↖ given

$P(\text{FB user})$ ↖

What is the chance FB or Tw is favorite?

YouTube, Instagram and Snapchat are the most popular online platforms among teens

% of U.S. teens who ...

	Say they use ...	Favorite app: Say they use __ most often
YouTube	85%	32%
Instagram	72	15
Snapchat	69	35
Facebook	51	10
Twitter	32	3
Tumblr	9	<1
Reddit	7	1
None of the above	3	3
	328	~100

Note: Figures in first column add to more than 100% because multiple responses were allowed. Question about most-used site was asked only of respondents who use multiple sites; results have been recalculated to include those who use only one site. Respondents who did not give an answer are not shown.
Source: Survey conducted March 7-April 10, 2018.
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10% + 3% = 13%

since it is not possible to be both FB favorite and Tw favorite.

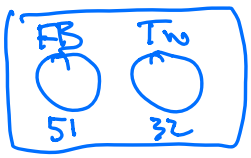
Sec 1.2 Probability Bound

Sometimes we can only give a bound for the answer

Ex what is the chance FB or Tw is used?

upper bound ?

lower bound ?



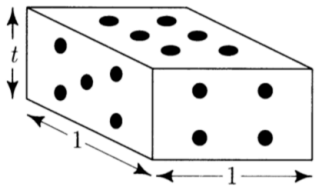
83 %

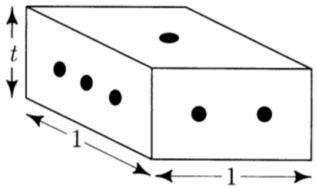
51 %

ex extra problems

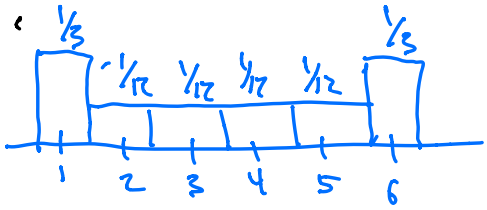
Shapes.

A *shape* is a 6-sided die with faces cut as shown in the following diagram:





Suppose the thickness of the die, t, is such that the chance of landing flat (1 or 6) is $\frac{2}{3}$. Find the probability distribution of the shape. Draw a histogram.



$P(1 \text{ or } 6) = \frac{2}{3} \Rightarrow P(1) = P(6) = \frac{1}{3}$.

This leaves $P(2 \text{ or } 3 \text{ or } 4 \text{ or } 5) = \frac{1}{3}$

$\Rightarrow P(2) = P(3) = P(4) = P(5) = \frac{1}{12}$.

Ex Two draws are made at random with replacement from the box

a) If you draw a 1, what is the chance the second number is bigger than 2?

$\Omega = \{(1,1),(1,2),(1,3),(1,4),(1,5),(1,6),(1,7),(1,8),(1,9),(1,10)\}$ — 10

$A = \{(1,>2)\}$ — 8

$P(A) = \frac{8}{10} = .8$

b) Find the chance the 2nd number is bigger than twice the first.

Ω = all pairs of numbers $(\#\Omega = 10 \cdot 10 = 100)$

$A = \{$ $(1,>2)$ — 8, $(2,>4)$ — 6, $(3,>6)$ — 4, $(4,>8)$ — 2, $(5,>10)$ — 0 $\}$

$\#A = 20$

$P(A) = \frac{\#A}{\#\Omega} = \frac{20}{100} = .2$

Correction

In class I asked you what is the chance the larger number is twice the smaller. For this the answer is .4.