This set time: theory, foundations
next time: combinatorics

read: JS ch.1 STAT 131

strongest evidence for correct cause -> effect

Conclusions:
Randomized controlled experiment (trivial) (RCT)

cause

Treatment: smoking

outcome: health

can't always use RCT on people (ethics)

observational study

health

health
bias: systematic tendency to over- or under-estimate the truth.

obs. studies can have (lots of) bias because of potential confounding factors (PCFs):

- Treatment ($T$): smoking (smoker vs. non-smoker)
- Outcome ($Z$): health (heart disease)
- PCF ($\Xi$): exercise

$\Theta$: statistical hypothesis

$P(\text{both} \mid \text{CH}) = P(\text{HH} \mid \text{II})$
\[ P( H_{165} \text{ and } H_{240} ) = \]
\[ = P( H_{257} | - ) \cdot P( H_{257}^2 \text{ toss } | - ) \]
\[ = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4} = 25\% \]

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pretend CH true \rightarrow \text{data under temporary pretend is unlikely;}
if so, CH looks bad (wrong)

25\% \text{ not P(all 9 heart disease death smokers | CH)}

\[ = P(H H H H H H H H H H H H | \text{IID fair}) \]
\[
\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{2^9} \cdot \frac{5}{12} = 0.002
\]

(Probably something wrong)

\{T,N\}
\[
\frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2^5} = 2^3 = 82
\]

\# of T-5 babies

\(P(10 \text{ more} \mid \text{ELM})\)
\[
\frac{10}{5} \cdot \frac{1}{6}
\]

0, 1, 2, 3, 4, 5

ELM true

right:
\[
1 - (1 - \theta)^5 = 76\%
\]
A, B disjoint \iff A \cap B = \emptyset

\iff (T/F prop.) A, B cannot both be true simultaneously

A, B independent \iff \text{Bayesian}

\because A doesn't change choice of B & we have \sum \square \emptyset

P(A \cap B) = P(A) \cdot P(B)
example of non-independence

\[ A = \{ \text{smoker} \} \]

\[ B = \{ \text{risk of \text{Heart Disease} \} \} \]

\[ P(B) = \text{small} \]

\[ P(B|A) \neq 1 \]

...A, B dependent...

\[ P(A \text{ and } B) = 0 \Rightarrow A, B \text{ mutually exclusive.} \]

\[ \Rightarrow A, B \text{ independent.} \]

\[ P(A \text{ and } B) = 0 = P(A) \cdot P(B) \]

\[ \to \text{ either } P(A) = 0 \text{ or } P(B) = 0 \text{ or both.} \]