4/9/19

Tuesday, April 9, 2019 1:33 PM

This time: (see sylabus) reading: see syllabus
Next time:

$P(\text{infected in 100 acts}) = P(\text{1 or more inf. 100 acts})$ (T-S)

$= 1 - P(\text{0 inf. in 100})$

$= 1 - P\left(\begin{smallmatrix}\text{not}\\ \text{inf}\\ \text{on 1st}\end{smallmatrix} \text{ and } \begin{smallmatrix}\text{not}\\ \text{inf}\\ \text{on 2nd}\end{smallmatrix} \text{ and } \dots \text{ and } \begin{smallmatrix}\text{not}\\ \text{inf}\\ \text{on 100th}\end{smallmatrix}\right)$

biology IID

$= 1 - P\left(\begin{smallmatrix}\text{not}\\ \text{inf}\\ \text{on 1st}\end{smallmatrix}\right) P\left(\begin{smallmatrix}\text{not}\\ \text{inf}\\ \text{on 2nd}\end{smallmatrix}\right) \cdots P\left(\begin{smallmatrix}\text{not}\\ \text{inf.}\\ \text{on 100}\end{smallmatrix}\right)$

biology → 1st order ≐

$= 1 - \left(1 - \frac{1}{500}\right)\left(1 - \frac{1}{500}\right) \cdots \left(1 - \frac{1}{500}\right)$

$= 1 - \left(1 - \frac{1}{500}\right)^{100} = 0.18 = 18\%$

$n = \#$ of acts $\qquad P(\text{inf. in } n \text{ acts}) = 1 - (1-p)^n$

$p = P(\text{inf.}$

Dr. Richard Doll

$P(\text{both smokers die first})$

$= P(HH) = P(HH \mid H^*)$

$= P(H \text{ on 1st and } H \text{ on 2nd})$

$= P(H \text{ on 1st}) \cdot P(H \text{ on 2nd})$

$= \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$ ⇒ insufficient evidence to "rule" on H^*

$P(\text{all 9 smokers die first}) = \frac{1}{2^9} = \frac{1}{512} = 0.2\%$

if H^* true, data highly unlikely; therefore H^* is probably false
(statistical inference)

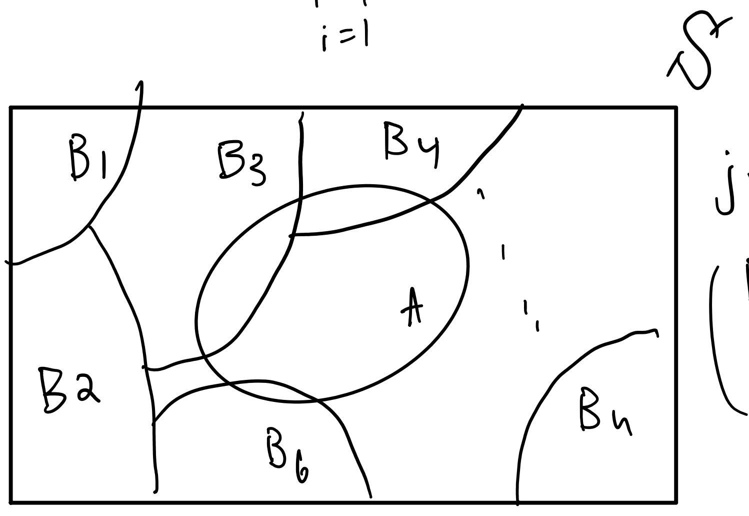
this idea = probabilistic version of proof by contradiction

$(A_1 \cup A_2 \cup \dots \cup A_n) = \bigcup_{i=1}^{n} A_i$ Union

if $A_1, A_2, \dots$ are all in $\mathbb{C}$ then so is $\bigcup_{i=1}^{\infty} A_i$

1. For any event A,
   $(A^c)^c = A$
2. $\emptyset^c = S$ and $S^c = \emptyset$
3. $A \cup B = B \cup A$
4. $A \cup B \cup C = (A \cup B) \cup C = A \cup (B \cup C)$

$A_1 \cap \dots \cap A_n = \bigcap_{i=1}^{n} A_i$

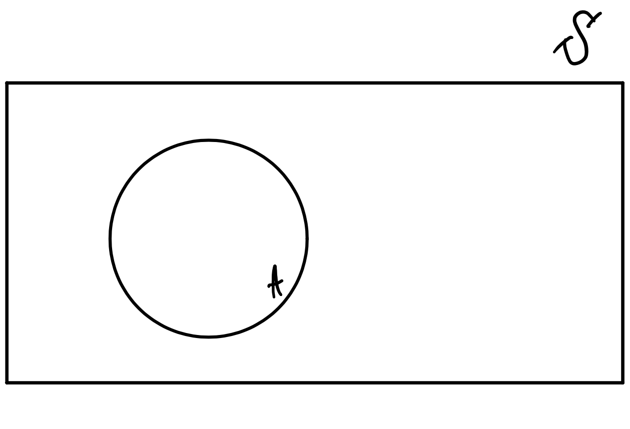


jigsaw puzzle

$\begin{pmatrix} B_1 \\ \vdots \\ B_n \end{pmatrix}$ ← partition of S

$P(A) = P[(A \text{ and } B_1) \text{ or } (A \text{ and } B_2) \text{ or} \dots \text{or } (A \text{ and } B_n)]$

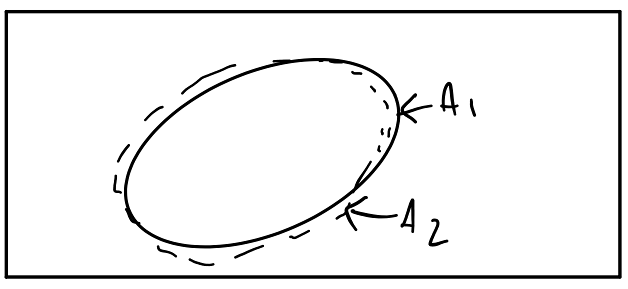
mutually exclusive $= P(\underline{A \text{ and } B_1}) + \dots + P(\underline{A \text{ and } B_n})$



Axiom 1: for all events $A \in \mathbb{C}$, $P_K(A) \geq 0$

Axiom 2: $P_K(S) = 1$

Axiom 3: $P_K\left(\bigcup_{i=1}^{\infty} A_i\right) = \sum_{i=1}^{\infty} P_K(A_i)$
disjoint $\qquad$ countable additivity



if $A_1 = A_2$
then $P_K(A_1) = P_K(A_2)$