DJ office
1.5 hour
14 Apr 20

Quiz 2 #2

STAT 131
14 Apr 20

known

n total balls

r red, $n-r$ not red

R

known

$P(R \text{ on } 1^{st} \text{ ball}) = \frac{r}{n}$

drawn one by one at random (SRS) without replacement

ELM? yes

$P(A)$ "marginal"

even though should be $P(A \mid \text{background info, assumptions, \& judgment})$

n even ; ex. $n = 22$

$P(11^{th} \text{ ball } R) = ?$

all marginally r/n

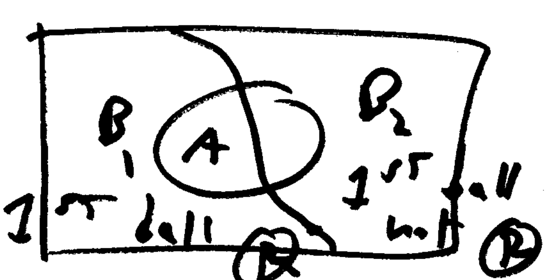
$\underline{17}$ $\underline{3}$ — — — . . $\underline{19}$ . . . $\underline{5}$

↑ 1^{st} ball ↑ 2^{nd} ↑ 11^{th} ↑ last n^{th} (22^{nd})

imagine that balls are numbered from 1 to n; then drawing them 1 by 1 at random without repl. is identical to writing down the numbers from 1 to n (left to right) in a random order; <u>marginally</u> (not knowing how the first $(k-1)$ balls came out),

$$P(\text{R on } k^{\text{th}} \text{ ball}) = \frac{r}{n}$$

$$\overbrace{P(\text{B on } 2^{\text{nd}} \text{ ball})}^{A} = \ ? \quad \text{hard}$$



partition over 1st ball

LTP

$P(\text{R on } 2^{nd} \text{ ball}) =$

$P(\underbrace{\text{R on } 2^{nd} \text{ ball}}_{A} \text{ and } \underbrace{\text{R on } 1^{st} \text{ ball}}_{B_1})$

$+ P(\underbrace{\text{R on } 2^{nd} \text{ ball}}_{A} \text{ and } \underbrace{\text{not R on } 1^{st} \text{ ball}}_{B_2})$

$= P(\text{R on } 1^{st} \text{ ball}) \cdot P(\text{R } 2^{nd} \mid \text{R } 1^{st})$

$+ P(\text{not R } 1^{st}) \cdot P(\text{R } 2^{nd} \mid \text{not R on } 1^{st})$

$$= \left(\frac{r}{n}\right)\left(\frac{r-1}{n-1}\right) + \left(\frac{n-r}{n}\right)\frac{r}{n-1}$$

$$= \frac{\cancel{r^2} - r + rn - \cancel{r^2}}{n(n-1)}$$

$$= \frac{r(n-1)}{n(n-1)} = \frac{r}{n} \checkmark$$

$$\underbrace{P(D \mid S)}_{\text{dead in 1992 / current smoker in 1972}} \overset{\downarrow (!)}{<} \underbrace{P(D \mid NS)}_{\text{never smoked as of 1972}}$$

Table 3

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as move from $\underbrace{NS \text{ to } S}_{X}$, $P(\text{dead}) \downarrow$ Y (!)

Table 1

$P(D \mid S, 18\text{-}64) > P(D \mid NS, 18\text{-}64)$

Table 2

$\boxed{P(D \mid S, 65+)} > P(D \mid NS, 65+)$

$\frac{46}{49} \doteq 92\%$ $\frac{161}{193} \doteq 80\%$

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after controlling for age

as move from $\underbrace{NS \text{ to } S}_{X}$, $P(\text{dead}) \uparrow$ Y

match	prize	probability
All 5 W & R	Grand prize GP	
All 5 W & not R	$1M	

$$P(\text{win}) = P(GP \text{ or } \$1M \text{ or } \$50k \text{ or } \ldots \text{ or } \$4 \text{ or } \$4)$$

$$\overset{\text{no overlap}}{=} P(GP) + P(\$1M) + \ldots \ldots + P(\$4\ (R))$$

(0.040)

$$\frac{1}{24.87} \doteq \frac{1}{292201338} + \frac{1}{11688053.52} + \ldots + \frac{1}{38.32}$$

$\boxed{P(A) = p_A}$ the odds ratio in favor of A = $o_A = \frac{p_A}{1-p_A}$

$o_A = \frac{P(A)}{P(\text{not } A)}$

the odds ratio against A =

$$O_{\text{not}A} = \frac{P(\text{not } A)}{P(A)} = \frac{1}{o_A}$$

$$= \frac{1-p_A}{p_A}$$

$$p_A = \frac{o_A}{1+o_A}$$

if p_A is close to 0, $O_A \doteq p_A$

$$\frac{* \; 5!}{69 \cdot 68 \cdots 65 \cdot 26} = \text{right answer}$$