IN R. FRA...

C5 1/30/20 - 1

C = CHIP IS GOOD

$P[C] = 1-p = .9$

$P[\bar{C}] = 0.1$

λ_{BAD}

$P[\text{ALIVE} @ t \mid \text{GOOD}] = e^{-t}$

$P[\text{ALIVE} @ t \mid \text{BAD}] = e^{-2t}$

I WANT $P[\text{ALIVE} @ T]$

USE TOTAL PROB THM.

$P[\text{ALIVE}] = P[\text{ALIVE} \mid \text{GOOD}]\, P[\text{GOOD}]$

$+ P[\text{ALIVE} \mid \text{BAD}]\, P[\text{BAD}]$

$= e^{-t} .9 + e^{-2t} .1$

~~= P[GOOD | A~~

~~WANT~~

$P[\text{GOOD} \mid \text{ALIVE}]$ ~~??~~

$= P[\text{GOOD} \,\&\, \text{ALIVE}] / P[\text{ALIVE}]$

IN R. FRAN...

2"

WE WANT

$P[\text{GOOD} \mid \text{ALIVE}]$

$.9e^{-t} + .1e^{-2t}$

KNOW $P[\text{GOOD} \mid \text{ALIVE}]\,P[\text{ALIVE}] =$

$P[\text{GOOD} \wedge \text{ALIVE}]$

$$P[\text{GOOD} \wedge \text{ALIVE}] = \underbrace{P[\text{ALIVE} \mid \text{GOOD}]}_{e^{-t}}\ \underbrace{P[\text{GOOD}]}_{.9}$$

$$P[A \mid B] = \frac{P[A \wedge B]}{P[B]} \rightarrow P[A \mid B]\,P[B] = P[A \wedge B]$$

$$P[\text{GOOD} \mid \text{ALIVE}] = \frac{P[\text{GOOD} \wedge \text{ALIVE}]}{P[\text{ALIVE}]} = \frac{.9e^{-t}}{.9e^{-t} + .1e^{-2t}}$$

WE WANT $t \ni P[G \mid A] \geq .99$

I WOULD PLOT IT + LOOK.

W. R. FRA...

DO YOU HAVE EBOLA?

D : EVENT THAT YOU DO.

D' DON'T.

WE HAVE AN IMPERFECT TEST.

T : EVENT THAT YOU TEST POSITIVE

T' -VE.

$P[T|D] = .99$ .01 FALSE -VE.

$P[T|D'] = .05$ FALSE +VE.

$P[D] = 0.001$ PRIOR

RUN THE TEST.

$P[T] = P[T|D]\,P[D] + P[T|D']\,P[D']$

$.99 \times .001 + .05 \times .999$

$.00099$ $\cancel{.949}$ $.05$

$= .05$

$\cancel{P[D|T]}$: $\cancel{P[D|T]\,P[T]} = \cancel{P[D \& T]}$

$\cancel{.99 \times .001}$

$= .00099$

$$P[D|T] = \frac{P[D \& T]}{P[T]} = \frac{.001}{.05} = .02$$

$P[D|T] >> P[D]$ BUT $<< 1$

NOISY CHANNEL

P[A] A : XMIT "1"

B : RCV "1"

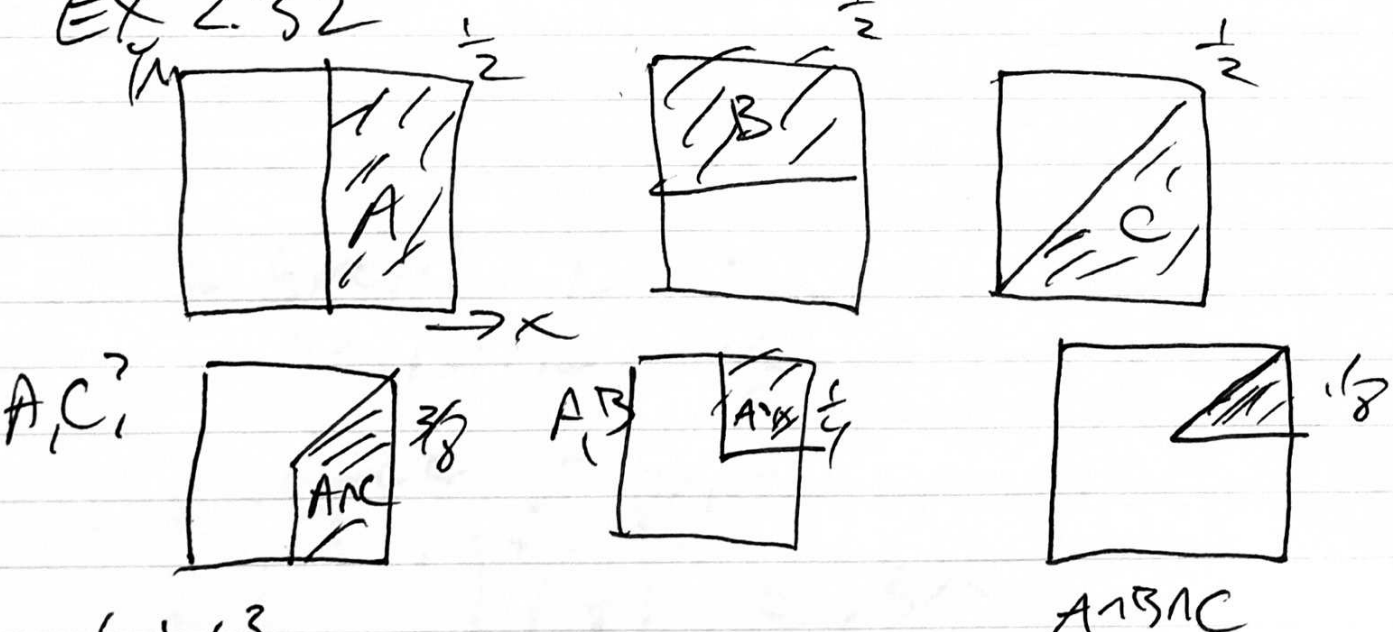
$P[A] = .01$ $P[B|A] = .9$

$P[B'|A'] = .8$

$P[B]$?

$P[A|B]$

EX 2.32



$\frac{1}{2}\frac{1}{2} \neq \frac{3}{8}$

DEP

TOSS OCTAHEDRON

$P[7] = \frac{1}{8}$

TOSS 4 TIMES.

I WANT P[EXACTLY 2 7'S]

$P = \frac{1}{8}$ $N = 4$ $K = 2$

$\binom{4}{2}\left(\frac{1}{8}\right)^2\left(\frac{7}{8}\right)^2 = 6 \cdot \frac{49}{4096}$

$= \frac{4!}{2!2!}$ $\approx .07$

$= 6$

NEW EVENT: NUMBER IS PRIME

$P[PRIME] = 1/2$ 2, 3, 5, 7

P[EXACTLY 2 PRIME OF 4]

$\binom{4}{2}\left(\frac{1}{2}\right)^2\left(\frac{1}{2}\right)^2 = .375$

$P[\text{EXACTLY 3 PRIMES}] = \binom{4}{3}\left(\frac{1}{2}\right)^1\left(\frac{1}{2}\right)^3 = \frac{4}{16} = .25$

W. R. FRAN...

L6

$P[\text{OCTAH SHOWED } 7] = \frac{1}{8}$

$P[K \text{ OF } 4] = \binom{4}{k} \left(\frac{1}{8}\right)^k \left(\frac{7}{8}\right)^{4-k}$

$P[0 \text{ OF } 4] = \left(\frac{7}{8}\right)^4$

$P[1 \text{ OF } 4] = 4 \left(\frac{1}{8}\right) \left(\frac{7}{8}\right)^3 =$

2 OF 4 $\quad 6 \left(\frac{1}{8}\right)^2 \left(\frac{7}{8}\right)^2$

3 $\quad 4 \left(\frac{1}{8}\right)^3 \left(\frac{7}{8}\right)$

4 $\quad \left(\frac{1}{8}\right)^4$

$\Sigma = 1$

$$\sum_{k=0}^{n} \binom{n}{k} p^k (1-p)^{n-k} = 1$$

W.R. FRA

PROOF

$$\underbrace{\left(p+(1-p)\right)^n}_{} = 1$$

$$= \sum_{k=0}^{n} \binom{n}{k} p^k (1-p)^{n-k}$$