Brian Murray

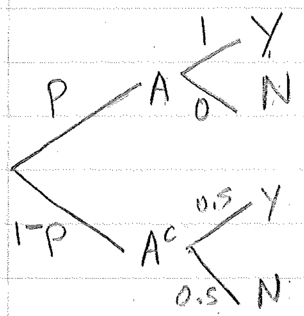
2/29 HW

30 p = prob that a person has "x-ed"

A = a person has x-ed

$$P(A \mid Y) = \frac{P(A) \cdot P(Y \mid A)}{P(A) P(Y \mid A) + P(A^c) P(Y \mid A^c)}$$

30 A
31 A
32 A
33 A



$$\frac{p \cdot P(Y \mid A)}{p \cdot P(Y \mid A) + (1-p) P(Y \mid A^c)}$$

$$\frac{p \cdot 1}{p \cdot 1 + (1-p)(\frac{1}{2})} \qquad \frac{p}{p + \frac{1}{2} - \frac{1}{2}p}$$

$$\frac{p}{\frac{1}{2}p + \frac{1}{2}} \qquad \boxed{\frac{2p}{p+1}} \qquad \frac{0.1}{0.1 + 0.9 \cdot 1/2} \qquad \frac{0.1}{0.1 + 0.5} \qquad \frac{0.2}{1.1} = \boxed{\frac{2}{11}}$$

Extra credit

- Then 3/4 of the answers would be meaningless Y's. You would throw out 750 out of the 1000 Y's and use the remaining Y's /250 to compute the answer

31. $P(A_2) = P(A_2 \cap A_1) + P(A_2 \cap A_1^c)$

$= P(A_2) \cdot P(A_1) + P(A_2 \cap A_1^c)$

$P(A_2 \cap A_1^c) = P(A_2) - P(A_2) P(A_1) = P(A_2)(1 - P(A_1))$

$= P(A_2) P(A_1^c)$

$P(A_2 \cap A_3)$ indep by definition same for A_3

$P(A_2 \cap A_3) = P(A_1 \cap A_2 \cap A_3) + P(A_1^c \cap A_2 \cap A_3)$

$P(A_1^c \cap A_2 \cap A_3) = P(A_2 \cap A_3) - P(A_1 \cap A_2 \cap A_3)$

$= P(A_2) \cdot P(A_3) - P(A_1) P(A_2) P(A_3)$

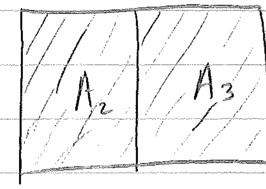
$= P(A_2) P(A_3) (1 - P(A_1))$

$= P(A_2) P(A_3) \cdot P(A_1^c)$

Therefore, A_1^c, A_2, A_3 are indep

32. 1, 2, 3 T   4 F

$A_1 = \phi$ and
A_2 and A_3 are disjoint ← each has positive probability $\frac{1}{2}$



33. 2, 3, 4 T   1 F

A_1, A_2 indep
A_1, A_3 indep
A_2, A_3 indep

In the picture,
$P(A_1) = P(A_2) = P(A_3) = \frac{1}{2}$

$P(A_1 \cap A_2 \cap A_3) = 0$
$P(A_1)P(A_2)P(A_3) = \frac{1}{8}$