

## Homework 3 Kaitlynn Prescott

### ① Toy Manufacturer

$A_1$  = bearing came from supplier 1

$A_2$  = supplier 2

$A_3$  = supplier 3

$B$  = bearing is defective

$$P(A_1) = .5, P(A_2) = .3, P(A_3) = .2$$

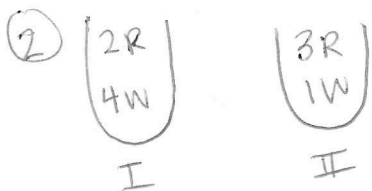
$$P(B|A_1) = .02, P(B|A_2) = .03, P(B|A_3) = .04$$

$$P(B) = \sum_{i=1}^n P(B|A_i)P(A_i)$$

$$P(B) = P(B|A_1)P(A_1) + P(B|A_2)P(A_2) + P(B|A_3)P(A_3)$$

$$= (.02)(.5) + (.03)(.3) + (.04)(.2)$$

$$P(B) = 0.027 = 2.7\%$$



1 chip transferred to urn II  
from urn I, then 1 chip  
picked from urn II.

$B_1$  = red transferred ( $\frac{2}{6}$ )

$B_2$  = white transferred ( $\frac{4}{6}$ )

$A$  = red drawn from Urn II

$$P(A) = P(B_1)P(A|B_1) + P(B_2)P(A|B_2)$$

$$= \left(\frac{2}{6}\right)\left(\frac{4}{5}\right) + \left(\frac{4}{6}\right)\left(\frac{3}{5}\right) = \frac{8}{30} + \frac{12}{30}$$

$$= \frac{20}{30} = \frac{2}{3}$$

$$P(A) = \frac{2}{3}$$

③  $\begin{pmatrix} 2W \\ 1R \end{pmatrix}$  I  $\begin{pmatrix} 1W \\ 2R \end{pmatrix}$  II 1 chip transferred from Urn I to Urn II. 1 chip then pulled from Urn II.

$P(\text{transferred chip is white} \mid \text{red chip pulled})$  ?

$B_1 = \text{White transferred } (\frac{2}{3})$

$B_2 = \text{red transferred } (\frac{1}{3})$

$A = \text{red pulled}$

$$P(B_1 | A) = \frac{P(B_1, A)}{P(A)} = \frac{P(B_1)P(A|B_1)}{P(B_1)P(A|B_1) + P(B_2)P(A|B_2)}$$

$$= \frac{(\frac{2}{3})(\frac{1}{2})}{(\frac{2}{3})(\frac{1}{2}) + (\frac{1}{3})(\frac{3}{4})} = \frac{\frac{1}{3}}{\frac{1}{3} + \frac{1}{4}} = \frac{4}{7}$$

$$P(B_1 | A) = \frac{4}{7}$$

④ Weather Satellite:

$S_0 = \text{Zero sent}$   $R_0 = \text{Zero recieved}$

$S_1 = \text{One sent}$   $R_1 = \text{One recieved}$

$$P(R_0 | S_0) = .8 \quad P(R_1 | S_0) = 0.2 \quad P(S_0) = .7$$

$$P(R_1 | S_1) = .8 \quad P(R_0 | S_1) = 0.2 \quad P(S_1) = .3$$

$$P(S_0 | R_1) = \frac{P(S_0, R_1)}{P(R_1)} = \frac{P(S_0)P(R_1 | S_0)}{P(S_0)P(R_1 | S_0) + P(S_1)P(R_1 | S_1)}$$

$$= \frac{(.7)(.2)}{(.7)(.2) + (.3)(.8)} = \frac{(.14)}{(.14) + (.24)}$$

$$P(S_0 | R_1) = .37$$

⑤ cervical cancer screening:

~~C~~ C = "a woman has the disease"

B = "positive biopsy"

$$P(C) = 0.0001 \left[ \frac{1}{10,000} \right] \quad * (P(C^c) = 1 - P(C) = .9999)$$

$$P(B|C) = .90$$

$$P(B|C^c) = 0.001 \left[ \frac{1}{1000} \right]$$

$$\begin{aligned} P(C|B) &= \frac{P(C \cap B)}{P(B)} = \frac{P(C)P(B|C)}{P(C)P(B|C) + P(C^c)P(B|C^c)} \\ &= \frac{(0.0001)(.90)}{(0.0001)(.90) + (.9999)(0.001)} = \frac{.00009}{(.00009) + (.0009999)} = 0.0825 \end{aligned}$$

$$P(C|B) = 0.0825 = 8.25\%$$