Homework 2

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MAS 608 HOMEWORK

1) An airline in a certain small town has the system: Everything will go right if none of their jets are with probability 0.93

a) Find the probability that at least one of the jets is glitching.

$P(\text{at least}) = 1 - 0.93 = 0.7$

5 flights:

$(0.7)(0.7)(0.7)(0.7)(0.7) = 0.7^5$

$= 0.16807$

(b) Find the probability that 5 or more flights depart on time — given only.

$P(3 \text{ or more departs on time}) =$

$1 - P(\text{less than 3 depart on time})$

$P(\text{all flights depart on time}) = 0.7^5 = 0.07$

$P(\text{exactly 4 depart on time}) = 0.7^4(0.7) = 0.0735 \cdot (5) = \frac{5!}{1!(4)!} = 5 = 0.07735$

$P(\text{3 flights depart on time}) = (0.7)^3(0.7)^2 \cdot (5) = \frac{5!}{3!(2)!} = \frac{5 \cdot 4}{2} = 10 = 0.1323$

$P(\text{7 flights}) = 0.7^5(0.7)^2 = \frac{5}{2}$

$P(\text{7 flights}) = 0.7^4(0.3)$

$1 - (0.07 + 0.07735 + .1323)$

$= 1 - 0.18765 = 0.81235$

(c) The local manager of the airline decides to make sure that the probability that all flights depart on time is 0.9. Determine the largest probability that individual can be late if the goal is to be achieved. Will the operation have to improve significantly?

$\sqrt[7]{x} = \sqrt[7]{0.90} = 0.9979$

$P(\text{Late}) = 1 - 0.9979 \approx 0.0021$

The current probability of a late departure is 0.3, which means this probability has to decrease by 0.2979. This is a very large decrease and the operation will have to improve significantly

2.

	H_0	H_1	H_2
L	0.1	0.1	0.2
B	0.4	0.1	0.1

(a) NH

$P(\text{No Headsets}) = P(H_0 \& L) + P(H_0 \& B)$

$P(NH) = 0.1 + 0.4 = 0.5$

(b) B

$P(\text{Brief}) = P(H_0 + B) + P(H_1 + B) + P(H_2 + B)$

$P(B) = 0.4 + 0.1 + 0.1 = 0.6$

(c) $P(A \text{ or } B) = P(A) + P(B)$

$P(L \text{ or } H_2) = P(L) + P(H_2) - P(L \text{ and } H_2)$

$P(L) = 0.4$

$P(H_2) = 0.3$

$P(L \text{ and } H_2) = 0.1 + 0.3 - 0.2$

$= 0.5$

(d)

$P(B \mid H_0) = \frac{P(B \text{ and } H_0)}{P(H_0)}$

$= \frac{0.4}{0.5}$

$P(B \mid H_0) = 0.8$

3.

	A	B
W	.95	.97
F	0.05	0.03

W: Works

F: Fails

(a) $P(A \cap B) = P(A)\,P(B) \neq 0$

$P(\text{System Fails}) = 1 - P(A \text{ Fails}) \cdot P(B \text{ Fails})$

SF

$P(SF) = 1 - (0.05) \cdot (0.03) = .9985$

(b) SF

$P(\text{System Fails}) = 0.90$

$P(A \text{ Fails}) = p$

$P(B \text{ Fails}) = p$

$P(SF) = 1 - p \cdot p = 1 - p^2 = 0.90$

$1 = 0.90 + p^2$

$-.90 \quad -.90$

$\sqrt{.10} = \sqrt{p^2}$

$\sqrt{.10} = p$

$0.316 = p$

(c) It is the same as above.

4) EP = Ectopic pregnancy

WS = Woman smoker

WN = Woman nonsmoker

$\frac{1}{3}$ of women are smokers

what % of women have EP are smokers?

$P(EP) = ?$

$P(WS) = \frac{1}{3}$

$P(WN) = 1 - WS = \frac{2}{3}$

$P(EP \mid WS) = 3(EP \mid WS)$

$P(EP \mid WS) = \frac{P(EP)\,P(WS)}{P(WS)}$

$P(WS \mid EP) = \frac{P(EP \mid WS)\,P(WS)}{P(EP)}$

$P(WS \mid EP) = \frac{(EP \mid WS)}{P(EP)}$

(b)

$P(D1) = \frac{2}{3}$ - Acceptable = 0.1

$P(\overline{D1}) = 1 - \frac{2}{3} = \frac{1}{3}$ - Not Acceptable $\overline{D1}$

$P(D2 \mid D1) = \frac{1}{3}$ - Acceptable 0.3

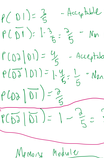
$P(\overline{D2} \mid D1) = 1 - \frac{1}{3} = \frac{2}{3}$ - Not Acceptable $\overline{D2}$

$P(D2 \mid \overline{D1}) = \frac{3}{5}$

$P(\overline{D2} \mid \overline{D1}) = 1 - \frac{3}{5} = \frac{2}{5}$

5

Memory Module



→ Will work if one chip is defective.

Chips = 9

Transistors = n

T = transistor Works

$\overline{T}$ = transistor Doesn't work

C = Chip Works

$\overline{C}$ = Chip Doesn't Work

M = Memory works

$\overline{M}$ = Memory Doesn't work

$P(T) = p$

$P(\overline{T}) = 1 - p$

$P(C) = 1 - P(\overline{C}) = 1 - (1 - p^n) = \cancel{1} - \cancel{1} + p^n = p^n$

$P(\overline{C}) = 1 - p^n$

$P(M) = P(\text{all 9 chips Work}) + P(\text{only 1 chip is defective})$

$= (p^n)^9 = p^{9n} + \quad (1 - p^n)(p^{9n})$

$P(\text{all 9 chips work}) = p^{9n}$

$P(\text{8 chips work}) = p^{8n}$

(a) $P(\text{Chip Works}) = p^n$

(b) $P(\text{Memory Module Work}) = p^{9n} + (1 - p^n)(p^{9n})$