HOMEWORK

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2.4) Given Here employee's of firm

* people with C/C++ known is Represents with $C = 70\% = 0.7$
* people with fortan known is $F = 60\% = 0.6$
* And people with both known fortan + C/C++ is

$$(C \cap F) = 50\% = 0.5$$

Sol)

a) Does not know fortan?

Sol) So we know people How know fortan =

$P(F) = 0.6$ we want $P(\bar{F}) = 1 - P(F)$

$= 1 - 0.6 = 0.4$

So people How ~~dont know~~ don't know $= 0.4$

b) Does not know fortan and C/C++

So we want $P(\bar{F} \cap \bar{C}) = 1 - P(F \cup C)$

$= 1 - [P(F) + P(C) - P(F \cap C)]$

(c) Know's C/C++ but not fortran:

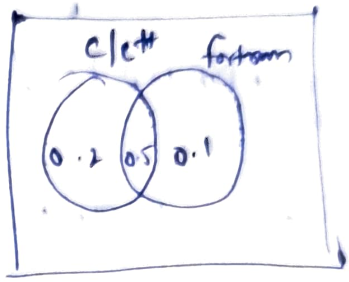
Sol) $p(\bar{C}) = \cancel{p(c)}\ p(c) - p(c \cap F)$

$= 0.7 - 0.5 = 0.2$

(d) know's fortran, but not C/C++

Sol) $p(\bar{F}) = p(F) - p(c \cap F)$

$= 0.6 - 0.5 = 0.1$



(e) If someone knows fortran, what is the probability that he/she knows C/C++ too?

Sol) total fortran known = 0.6

How knows Both is = 0.5

So fortran + C/C++' $p(F|C') = \frac{0.5}{0.6} = 0.833$

(f) If someone knows C/C++ what is the probability that he/she knows fortran too?

Sol) total C/C++ known = 0.7

How know's Both = 0.5

So the $p(C/C{+}{+}|F) = \frac{0.5}{0.7} = 0.714$

Q.5) Given Here $p(A) = 0.2$: Error found By test 1

$p(B) = 0.3$ " " " test 2

$p(C) = 0.5$ " " " test 3

* And also given 3 independent test so

$p(A \cap B \cap C) = \phi$ So $p(A \cap B \cap C) = p(A) \times p(B) \times p(C)$

* We want Not found probablites so

$p(\bar{A}) = 1 - 0.2 = 0.8$

$p(\bar{B}) = 1 - 0.3 = 0.7$

$p(\bar{C}) = 1 - 0.5 = 0.5$

* Required is found by atleast one test

So $= 1 - (p(\bar{A}) \times p(\bar{B}) \times p(\bar{C}))$

$= 1 - (0.8 \times 0.7 \times 0.5)$

$= 1 - (0.28) = \underline{0.82}$

Q.8) Given that a Shuttle break on key of fail independent Event. $p(A) = 0.01$, $p(B) = 0.02$ } failed Event

$p(\bar{C}) = 1 - 0.02 = 0.98$

So probability that all three do not fail is

$= 0.99 \times 0.98 \times 0.98$

$= 0.95$

2.11) Given that are 5 independent test's and probability of Error are

$p(A) = 0.1 \Rightarrow p(\bar{A}) = 1 - 0.1 = 0.9$
$p(B) = 0.2 \Rightarrow p(\bar{B}) = 1 - 0.2 = 0.8$
$p(C) = 0.3 \Rightarrow p(\bar{C}) = 1 - 0.3 = 0.7$
$p(D) = 0.4 \Rightarrow p(\bar{D}) = 1 - 0.4 = 0.6$
$p(E) = 0.5 \Rightarrow p(\bar{E}) = 1 - 0.5 = 0.5$

So (a) by at least one test means from total probability of - success case

$\Rightarrow = 1 - (0.9 \times 0.8 \times 0.7 \times 0.6 \times 0.5)$

$= 0.848$

(b) by at least two means

$= 1 - [0.9 \times 0.8 \times 0.7 \times 0.6 \times 0.5] - [0.1 \times 0.8 \times 0.7 \times 0.6 \times 0.5] - [0.9 \times 0.2 \times 0.7 \times 0.6 \times 0.5] - [0.9 \times 0.8 \times 0.3 \times 0.6 \times 0.5] - [0.9 \times 0.8 \times 0.7 \times 0.4 \times 0.5] - [0.9 \times 0.8 \times 0.7 \times 0.6 \times 0.5]$

$= 0.8488 - 0.0168 - 0.0848 - 0.1008 - 0.152$

$= 0.4774$

(c) By all test means all are failed condition so $0.1 \times 0.2 \times 0.3 \times 0.4 \times 0.5$

0.0012

2.14) Given No. of attempts = 1 million = 10,00,000

(a) 6 different lower-case letters.

Sol) 1st let (26) alphabet so.

_ _ _ _ _ _

if one letter is used we shouldn't use

So 26 25 24 23 22 21

Sol) $= 26 \times 25 \times 24 \times 23 \times 22 \times 21 =$ Total attempts

that is $\frac{10,00,000}{26 \times 25 \times 24 \times 23 \times 22 \times 21} = \frac{10^6}{165 \times 10^{6}} = \frac{1}{165} = 0.00$

(b) 6 different letters, upper, some may be upper case and it is case-sensitive

$\Rightarrow$ 52 51 50 49 48 47 $(26+26) = 52$ total

$= \frac{10^6}{\left(\frac{52!}{46!}\right)} = \frac{625}{9161334}$

(c) Any 6 letters, upper- or lower- case and it is case- Sensitive.

52 52 52 52 52 52

Sol)

* Here we have to repeat the numbers again.

So) $\frac{10^6}{(52)^6}$

(d) Any 6 letters including letter and digits and Case Sensitive.

Sol).

62 62 62 62 62 62

26 (lower Case)
26 (upper Case)
10 (digits)(0-9).
52+10 = 62.

* We are 1 millions

$= \frac{10^6}{(62)^6}$

2.16) Given: $p(S_1) = 0.5$ | $p(D|S_1) = 0.05$
$p(S_2) = 0.2$ | $p(D|S_2) = 0.03$
$p(S_3) = 0.3$ | $p(D|S_3) = 0.06$

We need to find $p(S_1|D)$

(a) By the law of total probability.

$p(D) = p(D|S_1)\,p(S_1) + p(D|S_2)\,p(S_2) + p(D|S_3)\,p(S_3)$

$= (0.05)(0.5) + (0.2)(0.03) + (0.3)(0.06)$

$= 0.049$

(b) Bayes Rule:

$$p(S_1|D) = \frac{p(D|S_1)\,p(S_1)}{p(D)} = \frac{(0.5)(0.05)}{0.49} = \frac{25}{49} = 0.$$

2.18) Given $p(\bar{G}) = 0.75$

$p(C|\bar{G}) = 0.9$

$p(C|G) = 1/4 = 0.25$

Also $p(G) = 1 - 0.75 = 0.25$

Then By the Bayes Rule,

$$p(G|C) = \frac{p(C|G)\,p(G)}{p(C|G)\,p(G) + p(C|\bar{G})\,p(\bar{G})}$$

$$= \frac{(0.25)(0.25)}{(0.25)(0.25) + (0.9)(0.75)} = 0.0847$$

2.23). Given $p(A) = 0.9$

$p(B) = 0.8$

$p(C) = 0.7$

$p(D) = 0.6$

$p(E) = 0.5$

So Now A and B are in series. So, reliability

$= p(A \cap B) = p(A)\, p(B)$

$= 0.9 \times 0.8 = 0.72$

2.29) Given $t = 9$ be total number of databases, of which $n = 4$ have no and $k = 5$

let $c = 4$ databases chosen and s databases

The Question is asking to find $s \geq 2$ ie

$S = 2, 3, 4$

$$p(S \geq 2) = p(S=2) + p(S=3) + p(S=4)$$

$$= \frac{\binom{5}{2}\binom{4}{2}}{\binom{9}{4}} + \frac{\binom{5}{3}\binom{4}{1}}{\binom{9}{4}} + \frac{\binom{5}{4}\binom{4}{0}}{\binom{9}{4}}$$

$$= \frac{60 + 40 + 5}{126} = \frac{35}{42} \simeq 0.83$$

2.30) All outcomes are listed in the table below. According to the problem, they are Equally like

(a)

Outcome	The older child	The younge child	Who is me[illegible]
1	girl	girl	The older g[illegible]
2	girl	girl	The younger
3	girl	boy	the girl
4	girl	boy	the girl
5	boy	girl	The girl
6	boy	girl	The boy
7	boy	boy	The older [illegible]
8	boy	boy	The young[illegible]

(b) $p\{BB\} = p(7,8) = 1/4$

$p\{BG\} = p(5,6) = 1/4$

$p(GB) = p(3,4) = 1/4$

(c) $p(7,8) = 1/2$

$p(6|Jimm) = 1/4$

$p(4|Jim) = 1/4$

(d) $p(4,6|Jimm)$

$= 1/2$

3.7) Given

x = No. of Home runs in one game

$y = n*x$ = No. of home runs in n game.

n is some positive whole number.

if $n=2$ then

$y = n*x$

$y = 2x$

x	$p(x)$	$x*p(x)$
0	0.4	$0*0.4=0$
1	0.4	$1*0.4=0.4$
2	0.2	$2*0.2=0.4$

c) $y = a+bx$ then,

$E(y) = E(a+bx)$

$E(y) = E(a)+E(bx)$

$= E(a)+b*E(x)$

* new coloum is $0+0.4+0.4 = \underline{0.8}$

$E(y) = a+b*E(x)$

$= 2(0.8)$

$= \underline{1.6}$

* $Var(x) = E(x^2) - [E(x)]^2$

$Var(y) = b^2 Var(x)$

$= 2^2 Var(x)$

$= 4(0.56)$

$= \underline{2.24}$

3.9) Given to Solve in Chebyshev's inequality

$$P(|x-\mu| \geq k) \leq (\sigma^2/k^2)$$

$\therefore \sigma^2 = 5$ (Standard deviation)

$\mu = 40$

$k = 1$

$\therefore \sigma^2/k^2 = (5)/1^2 = 25\%$

3.18) Given for $E(X)$

$P_A(1) = P_B(1) = 0.5$, $P_B(-1) = 0$

$E_A(X) = E_B(X) = (1)(0.5) + (-1)(0.5) = 0.$

To obtain Variance

$E_A(X^2) = E_B(X^2) = (1^2)(0.5) + (-1)^2(0.5)$

$= 0.5 + 0.5$

$= 1$

a) 100 Share's $\times$ \$10 $\times$ $X/10$

$E(A) = E(100X) = 100\,E(X) = 100 \times 0 = 0$

$Var(A) = 100^2(var(X)) = 10,000 \times 1 = 10,000$

b) 50 Shares $\times 10 \times X/10 + 10$ shares $(50) + Y/50$

Spent) $= 50X + 10Y$

$E(X) = E(50X) + E(10Y) = 50(0) + 10(0) = 0$

$Var(X) = (50)^2 (Var(X)) + 10^2 (Var(Y))$

$= 50^2 + 10^2 = 2500 + 100 = 2600$

c) 40 Shares $(10)(X/10) + 12(50) + Y/50$

Spent) $= 40X + 12Y$

$E(X) = E(40X) + E(12Y) = 40(0) + 12(0) = 0$

$Var(X) = 40(2)(Var(X)) + (12)^2(Var(Y))$

$= 1600 + 144 = \underline{1744}$

3.25) Given, The proportion of user who do not close window's properly $= 0.10$

So: The proportion of users who close windows properly $= 1 - 0.10 = 0.90$,

Assume, the No. of users $= 25$

a) The Expected users who have closed windows properly $= 25(0.90) = \underline{22.5}$

b) The Expected users who do not close windows properly $= 25(0.10)$

$= 2.5$

3.27) Given $p(X \geq 5) = 1 - p(X \leq 4)$

a)

$= 1 - (0.55)$

$= 0.945$

b)

Given $p(x=5) = \frac{e^{-\lambda}\lambda^{x}}{x!} = \frac{e^{-9}(9)^5}{5!} = 0.607$

3.28) Given assume that X has a poisson distribution

$pr(X \leq \lambda/2) \leq 4/\lambda$

Chebyshev's inequality

$p(|X - E(X)| \geq a) \leq \frac{Var(X)}{a^2}$

The Event $\{X \leq \lambda/2\} \subset \{X \leq \lambda/2\} \cup \{X \geq 3\lambda/2\}$

$= \{|X - \lambda| \geq \lambda/2\}$

3.35) Given let T = Thunderstorm

X = poisson

$p(T/X=7) = \frac{p(T \cap X=7)}{p(X=7)} = \frac{p(X=7/T)\,p(T)}{p(X=7/T)\,p(T) + p(X=7/notT)\,p(notT)}$

$$= \frac{\left(\frac{e^{-10}(10^7)}{7!}\right)0.6}{\left(\frac{e^{-10}10^7}{7!}\right)0.6 + \left(\frac{e^{-4}(4)^7}{7!}\right)0.4} = \underline{\underline{0.6941}}$$