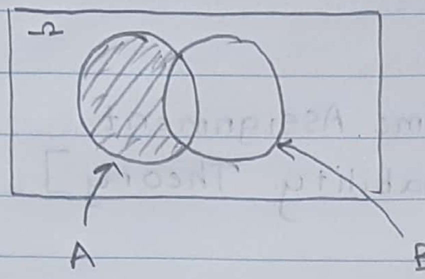
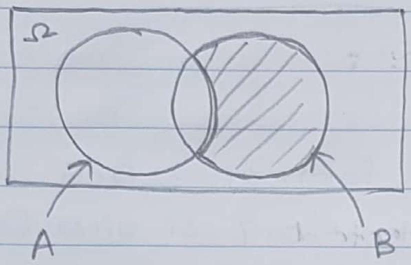
IT18125726

c) knows C/C++ but not ~~C/C++~~ fortran?



$$A \text{ not } B = P(A) - P(A \cap B)$$
$$= 0.7 - 0.5$$
$$= 0.2$$ //

D) knows fortran but not C/C++?



$$B \text{ not } A = P(B) - P(A \cap B)$$
$$= 0.6 - 0.5$$
$$= 0.1$$ //

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

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.5}{0.6} = 0.83333$$ //

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

$$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{0.5}{0.7} = 0.7142857$$ //

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2) Among 10 laptop computers, five are good and five have defects. Unaware of this, a customer buys 6 laptops

a) What is the probability of exactly 2 defective laptops among them?

P(G) = good laptops = 5
P(D) = defects laptops = 5

No of ways to select 6 laptops

n = Total objects to select
k = No of objects that selected

$$^nC_k = \frac{n!}{k!\,(n-k)!} = \frac{10!}{6! * 4!} = \frac{\cancel{1\times2\times3\times4\times5\times6}\times7\times\cancel{8}^{2}\times\cancel{9}^{3}\times10}{\cancel{1\times2\times3\times4\times5\times6}\times1\times\cancel{2}\times\cancel{3}\times\cancel{4}}$$

$= 210$

No of chances exactly 2 defective laptops are parches among them?

n = Total defective laptops
k = No. of selection $\Rightarrow$ 1st selection = $^nC_k = \frac{n!}{k!\,(n-k)!}$

$$= \frac{5!}{2!\,3!}$$

$$= \frac{1\times2\times3\times\cancel{4}^{2}\times5}{1\times\cancel{2}\times1\times2\times3}$$

$= 10$ //

2nd selection (Because here outputs are not replacing and without concidering the order) $\Rightarrow$

$$^nC_k = \frac{n!}{k!\,(n-k)!} = \frac{5!}{4!\,1!} = 5$$

2 a) given 2 purchased laptops are defective →

$5 * 10 = 50$

probability of exactly 2 are defective $= \frac{50}{210}$

$= \frac{5}{21}$ //

0.23809 //

2 b) Given that atleast 2 purchased laptops are defective, what is the probability ~~of~~ that exactly 2 are defective

For one defective laptop $= 5C1 * 5C5 / 10C6$

$= \frac{5!}{1!(5-1)!} * \frac{5!}{5!} \Big/ \frac{10!}{6!(10-6)!}$

$\frac{\cancel{1 \times 2 \times 3 \times 4} \times 5}{1 \times \cancel{1 \times 2 \times 3 \times 4}} * 1 \Big/ 210 = \frac{5}{210} = 0.0238$

ATleast 2 laptops defective = 0.23809 + 0.023809

= 0.262 //

(3) A problem on a multiple-choice quiz is answered correctly with probability 0.9 if a student is prepared. An unprepared student guesses between 4 possible answers, so the probability of choosing the right answer is 1/4. Seventy five precent of students prepare for the quiz. If Mr. X gives a correct answer to this problem, what is the chance that he did not prepare for the quiz?

$p(c)$ = choosing correct answer =
$p(c')$ = choosing wrong answer
$p(p)$ = prepared student = 0.75
$p(p')$ = unprepared student = 0.25

$p(c|p) = 0.9$ $\quad p(p'|c) = ?$ $\quad p(c|p') = 0.25$

By using total probability theorem

$$p(c) = p(c \cap p) + p(c \cap p')$$
$$= p(c|p) \cdot p(p) + p(c|p') \cdot p(p')$$
$$= 0.9 \cdot 0.75 + 0.25 \cdot 0.25$$
$$= 0.675 + 0.0625$$
$$= 0.7375 \ //$$

$$p(c|p') = \frac{p(p'|c) \cdot p(c)}{p(p')}$$ by byes theorm

$$\frac{p(c|p') \cdot p(p')}{p(c)} = p(p'|c)$$

$$\frac{0.25 \cdot 0.25}{0.7375} = p(p'|c)$$

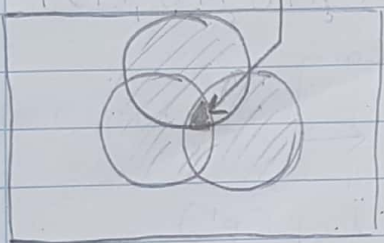
$$p(p'|c) = 0.0847 \ //$$

4) Successful implementation of a new system is based on 3 independent modules. Module 1 works properly with probability 0.96. for modules 2 and 3, these probabilities equal 0.95 and 0.90. Compute the probability that at least one of these 03 modules fails to work properly

Module 1 works properly $P(M_1) = 0.96$
Module 2 works properly $P(M_2) = 0.95$
Module 3 works properly $P(M_3) = 0.90$

All 03 components work propaly $\Rightarrow$ ($\because$ all 03 components are independent)

$$P(M_1 \cap M_2 \cap M_3) = 0.96 \cdot 0.95 \cdot 0.90$$
$$= 0.8208$$



Compliment of $P(M_1 \cap M_2 \cap M_3)$ is the probability that at least one of these 03 Modules fails to work properly $\Rightarrow$

$$\therefore P(M_1 \cap M_2 \cap M_3)' = 1 - P(M_1 \cap M_2 \cap M_3)$$
$$= 1 - 0.8208$$
$$= 0.1792$$

5) At a plant, 20% of all the produced parts are subject to a special electronic inspection. IT is known that any produced part which was inspected electronically has no defects with probability 0.95. for a part that was not inspected electronically this probability is only 0.7. A customer receives a part and find defects in it. what is the probability that this part went through an electronic inspection

All produced parts of a plant go through electronic inspection $\Rightarrow P(I) = 0.2$

Produced part which was e. inspection has no defects $\Rightarrow P(N) =$ ____

$P(N|I) = 0.95$ $\quad P(N|I') = 0.7$ $\quad P(I|N') = ?$

from 2nd Axiom $\Rightarrow$

$$P(N'|I) = 1 - 0.95 = 0.05$$

$$P(N'|I') = 1 - 0.7 = 0.30$$

$$P(N'|I) = \frac{P(I|N')P(N')}{P(I)}$$

We have to find N'

$$P(N') = P(N' \cap I) + P(N' \cap I')$$

$$= P(N'|I).P(I) + P(N'|I').P(I')$$

$$= 0.05 \times 0.2 + 0.3 \times 0.8$$

$$0.01 + 0.24 = 0.25 //$$

$$\frac{P(N'|I) \times P(I)}{P(N')} = P(I|N')$$

$$\frac{0.05 \times 0.2}{0.25} = P(I|N')$$

$$\frac{0.01}{0.25} = 0.04 \Rightarrow P(I|N') = 0.04 //$$

6) Among 18 computers in some store, six have defects. 5 randomly selected computers are bought for the university lab. Compute the probability that all five computers have no defects.

No of computers $(n) = 18$

picking computer with defects $= \frac{6}{18} = \frac{1}{3}$

picking a computer without defects $= \frac{12}{18} = \frac{2}{3}$

picking up 5 non-defected computers are done with a order an without replacement. so,

No of objects gonna select $(k) = 5$

probability that all 5 computers have no defects $= \left(\frac{2}{3}\right)^5$

$$= \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} = \frac{32}{243}$$

$$= 0.1316872$$ //

7. A computer maker receives parts from 3 suppliers; S1, S2 and S3. ~~fifty~~ 50 %. come from S1, 20% from S2, and 30% from S3. Among all the parts supplied by S1, 5% are defective. For S2 and S3, the portion of defective parts is 3% and 6%, respectively.

a) What portion of all the parts are defective?

parts supply by S1 = $P(S1) = 0.5$
parts supply by S2 = $P(S2) = 0.2$
parts supply by S3 = $P(S3) = 0.3$
All Defective parts (D)

parts defected by S1 $\Rightarrow P(D|S1) = 0.05$
parts defected by S2 $\Rightarrow P(D|S2) = 0.03$
parts defected by S3 $\Rightarrow P(D|S3) = 0.06$

from Total probability theorm →

$$P(D) = P(S1)P(D|S1) + P(S2)P(D|S2) + P(S3)P(D|S3)$$
$$= 0.5 * 0.05 + 0.2 * 0.03 + 0.3 * 0.06$$
$$= 0.025 + 0.006 + 0.018$$
$$= 0.049 \quad //$$

b) A customer complains that a certain part in her recently purchased computer is defective. What is the probability that it was supplied by S1?

Apply bayes theorm

$$(S1|D) = \frac{(D|S1).S1}{D} = \frac{0.05 * 0.5}{0.049}$$

$$= 0.51020 \quad //$$

8) A computer program consists of 2 blocks written independently by 2 different programmers. The first block has an error with probability 0.2. The 2nd block has an error with probability 0.3. If the program returns an error, what is the probability that there is an error in both blocks?

error returns by block 01 $(E1) = 0.2$

error returns by block 02 $(E2) = 0.3$

because these two programs are independent

$$P(E1 \cap E2) = P(E1) * P(E2)$$
$$= 0.2 * 0.3$$
$$= 0.06$$ //

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IT3011 TPSM - Take home Assignment [Probability Theory]

01. Among employees of a certain firm. 70% know c/c++, 60% know fortran and 50% know both languages. What portion of programmers

a) does not know fortan ?

P(B) = employees who know fortran = 0.6

P(A) = employees who know c/c++ = 0.7

P(A') = employees who does not know c/c++ = ?

P(B') = employees who does not know fortran = ?

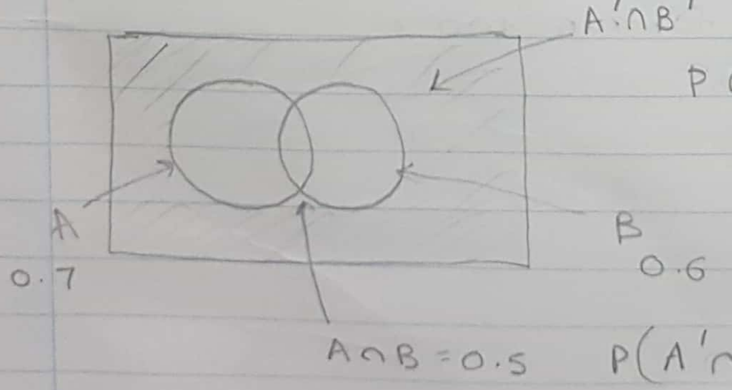
With 2nd probability axiom $\Rightarrow$ $P(B) + P(B') = 1$

$0.6 + P(B') = 1$

$P(B') = 1 - 0.6$

$= 0.4$ //

b) does not know fortan and does not know $C/c++ ?



$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= 0.7 + 0.6 - 0.5$

$= 1.3 - 0.5$

$= 0.8$

$P(A' \cap B') = 1 - P(A \cup B)$

$= 1 - 0.8$

$= 0.2$ //