UTM UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF COMPUTING
Faculty of Engineering

Subject : PROBABILITY & STATISTICAL DATA ANALYSIS

Section : 05

Assignment :- 02

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ANS TO THE QUESTION NO: - 01

Answer to the question no. 1

(a)

The probability that the subject will be rated as average, easy, or very easy,

$$P(C \cup B \cup A) = P(C) + P(B) + P(A)$$
$$= 0.34 + 0.29 + 0.08$$
$$= 0.71.$$

Ans: 0.71.

(b)

The probability that the subject will be rated as average, difficult or very difficult,

$$P(C \cup D \cup E) = P(C) + P(D) + P(E)$$
$$= 0.34 + 0.17 + 0.12$$
$$= 0.63.$$

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Ans: 0.63.

(c)

The probability that the subject will be rated as not very difficult,

$P(E') = 1 - P(E)$

$= 1 - 0.12$

$= 0.88.$

The probability that the subject will be rated as not very easy,

$P(A') = 1 - P(A)$

$= 1 - 0.08$

$= 0.92.$

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∴ The probability that the subject will be rated as neither very difficult nor very easy, $P(E' \cap A') = P(E') \times P(A')$

$= 0.88 \times 0.92$

$= 0.8096.$

Ans: 0.8096

(d)

The probability that the subject will be rated as difficult or very easy,

$P(D \cup A) = P(D) + P(A)$

$= 0.17 + 0.08$

$= 0.25.$

Ans: 0.25.

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ANS TO THE QUESTION NO: - 02

Answer to the question no. 2

(a)

We know,

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

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

$$= 0.6 + 0.3 - 0.8$$

$$= 0.1.$$

Ans: 0.1.

(c)

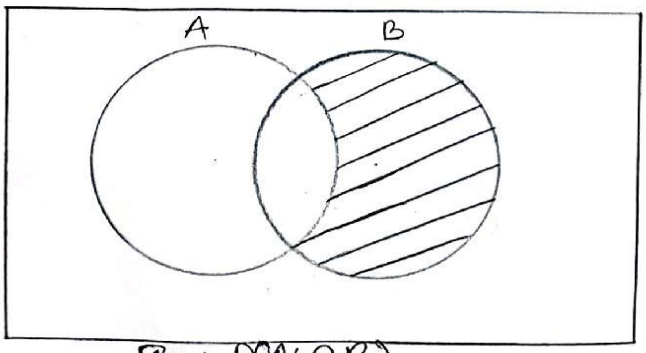

Fig : $P(A' \cap B)$

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$P(A' \cap B) = P(B/A)$

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

$= 0.3 - 0.1$

$= 0.2$

(d)

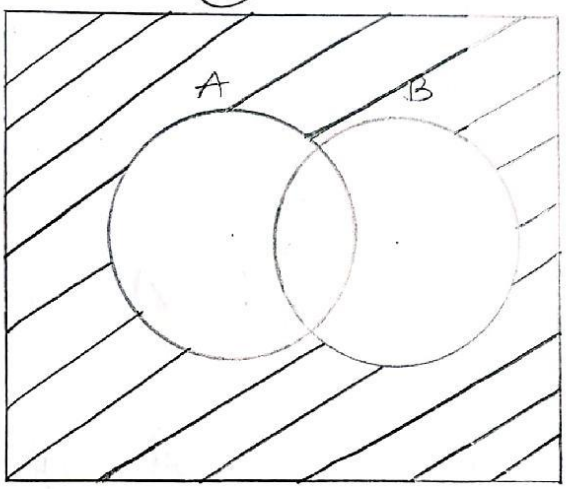

Fig: $P(A' \cap B')$.

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

$= 1 - 0.80$

$= 0.2$

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(e)

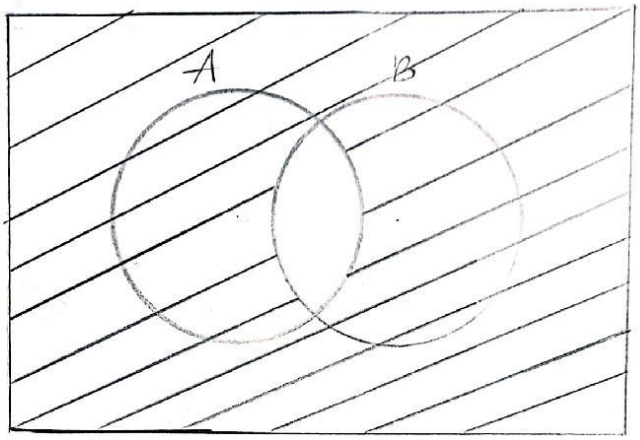

Fig : $P(A' \cup B')$.

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

$$= 1 - 0.1$$

$$= 0.9.$$

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(f)

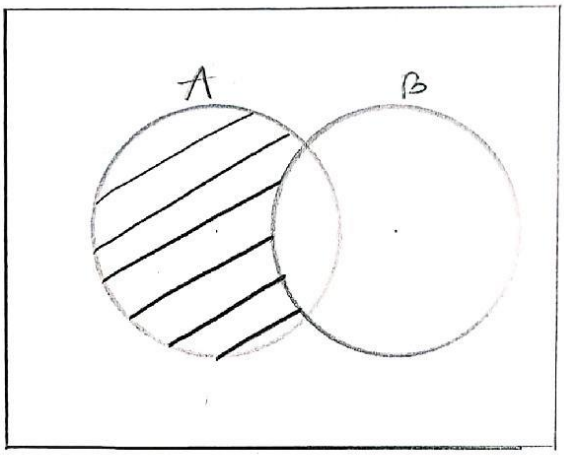

Fig : $P(A \cap B')$

$$P(A \cap B') = P(A/B)$$
$$= P(A) - P(A \cap B)$$
$$= 0.6 - 0.1$$
$$= 0.5$$

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ANS TO THE QUESTION NO: - 03

Ans to the question NO: 03

So,
Here, Bad services,

Package A = 20%.
= 0.2
↳ Probability → 0.002

Package B = 45%.
= 0.45
↳ P " → 0.001

Package C = 35%.
= 0.35.
↳ P → 0.003.

So,
we can take,

Good Service = GS

Bad Service = BS.

And,
the probability of good service,

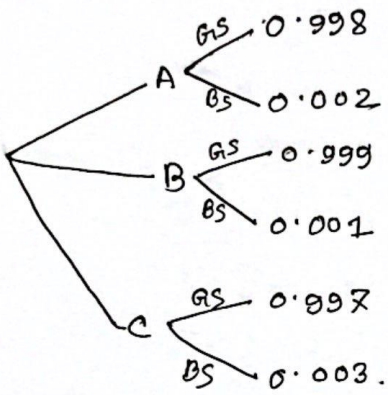
⇒ 1 − Probability of Bad Services

⇒ Pacakage A = 1 − 0.002 = 0.998

Package B = 1 − 0.001 = 0.999

Package C = 1 − 0.003 = 0.997.

(02) (a) tree diagram,



(03) (b)

Probability of (GS) = $P(A)_{GS} + P(B)_{GS} + P(C)_{GS}$

$= 0.2(0.998) + 0.45(0.999) + 0.35(0.997)$

$= 0.1996 + 0.449 + 0.348$

$= 0.997.$

(03) (c)

So,

desirable = P(B)

$= 0.45\,(0.999)$

$= 0.449$

Possible = P(GS)

$= 0.997$ (get from 3b).

So,

Probability of Pacakage B for operating smooth

$\Rightarrow \dfrac{\text{desirable } P(B)}{P(GS)}$

$= \dfrac{0.449}{0.997}$

$= 0.4503.$

ANS TO THE QUESTION NO: - 04

Ans to the question No: 04

(4) (a) X is a binomial random variable because there are only two outcome.

(4) (b)

Probability of 8 product purchased are banana flavor milk,

$$b(8, 20, 0.4)$$

$$= \binom{20}{8} (0.7)^8 (0.3)^{12}$$

$$= 0.0039.$$

(04) c

$b(7 < x < 10)$

here,

$x = (8, 9)$

$b(x=8) + b(x=9)$

$= \left[{}^{20}C_8 (0.7)^8 . (0.3)^{20-8}\right] + \left[{}^{20}C_9 (0.7)^9 . (0.3)^{20-9}\right]$

$= 0.0039 + 0.012$

and also,

Probability of 10 product purchased, is =

$b(10; 20, 0.7) = \binom{20}{10} (0.7)^{10} . (0.3)^{10}$

$= 0.0308$

and,

Probability of 7,

$b(7; 20, 0.7) = \binom{20}{7} (0.7)^7 . (0.3)^{20-7}$

$= 0.00102$

So,

Probability

$= (0.0039 + 0.012 + 0.0308 + 0.00102)$

$= 0.04772.$

04 (d)

Probability of 3 kurma flavor milk

$b(3; 20, 0.3) = \binom{20}{3} (0.3)^3 \cdot (0.7)^{20-3}$

$= 0.0716$

$= 0.0716.$

Probability of 4 kurma flavor milk,

$b(4; 20; 0.3) = \binom{20}{4} (0.3)^4 \cdot (0.7)^{20-4=16}$

$= 0.13042.$

(04) d

Probability of 5 kurma flavor,

$$b(5; 20, 0.3) = \binom{20}{5} \cdot (0.3)^5 (0.7)^{20-5=15}$$

$$= 0.17886$$

So,

Probabity of between 3 and 5,

$$= (0.0216 + 0.13042 + 0.17886)$$

$$= 0.38089.$$

(Ans).

ANS TO THE QUESTION NO: - 05

Ans. to the Ques NO. 05.

a)

i) $b^*(x;k;p) = {}^{x-1}C_{k-1}\, p^k . q^{x-k}$

$\Rightarrow (3;1;0.7) = {}^{2}C_{0}(0.7)^1(1-0.7)^2$

$= 1 \times 0.7 \times 0.09$

$= 0.063$

ii) $b^*(x<4) = (1 \le x \le 3)$ Ans.

$\therefore x = 1,2,3$

Now, $b^*(x;k;p) = {}^{x-1}C_{k-1}\, p^k . q^{x-k}$

$\Rightarrow (1;1,0.7) = {}^{0}C_{0}(0.7)^1(1-0.7)^0 \quad [\because x=1]$

$= 0.7$

Again,

$b^*(x;k;p) = {}^{x-1}C_{k-1}\, p^k . q^{x-k}$

$\Rightarrow (2;1;0.7) = {}^{1}C_{0}(0.7)^1(1-0.7)^1 \quad [\because x=2]$

$= 0.21$

lastly,

$b^*(x;k;p) = {}^{x-1}C_{k-1}\, p^k . q^{x-k}$

$\Rightarrow (3;1;0.7) = {}^{2}C_{0}(0.7)^1(1-0.7)^2 \quad [\because x=3]$

$= 0.063$

Now,

$0.7 + 0.21 + 0.063$

$= 0.973$

Ans.

iii) $b^*(x \leq 7)$

$\therefore 1 - b^*(x \leq 7)$

$= 1 - [b^*(5) + b^*(6) + b^*(7)]$

here,
$x = 5, 6, 7$
$K = 5$
$q = 1 - 0.7$
$= 0.3$

$= 1 - [({}^4C_4)(0.7)^5(1-0.7)^0 + ({}^5C_4)(0.7)^5(1-0.7)^1 + ({}^6C_4)(0.7)^5(1-0.7)^2]$

$= 1 - (0.168 + 0.252 + 0.22)$

$= 1 - 0.6468$

$= 0.3532$

Ans.

b) Given,

$K = 5$

$P = 0.7$

Mean,

$$\mu = \frac{K}{P} = \frac{5}{0.7}$$

$= 7.143$

Variance,

$$\sigma^2 = \left(\sqrt{\frac{K(1-P)}{P^2}}\right)^2$$

$$= \frac{5(1-0.7)}{0.7^2}$$

$= 3.061$

Ans.

ANS TO THE QUESTION NO: - 06

Question - 6

a) Given, $\mu = 36kg$

$\sigma = 0.1\ kg$ | According to the question,

$36.2 < x < 35.8$

We know,

$$Z = \frac{x - \mu}{\sigma}$$

So, taking, $x = 35.8$

$$\Rightarrow Z = \frac{35.8 - 36}{0.1}$$

$$\Rightarrow Z = -2$$

$x = 36.2$ | taking $x = 36.2$

$$\Rightarrow Z = \frac{36.2 - 36}{0.1}$$

$$\Rightarrow Z = 2$$

by using Z standard probability calculation,

$P(Z < -2) = 0.02275$

$P(Z > 2) = 0.02275$

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So, probability,

$$= P(x < 35.8) + P(x > 36.2)$$

$$= P(z < -2) + P(z > 2)$$

$$= 0.02275 + 0.02275$$

$$= 0.0455$$

[Ans:]

b) Given,

Total inspection, $n = 16$

from, @ probability of success $P = 0.0455$

we know,

$$P(X = x) = \frac{n!}{x!(n-x)!} \cdot p^x \times (1-p)^{n-x}$$

$$\Rightarrow P(x = 0) = \frac{16!}{0!(16-0)!} (0.0455)^0 \cdot (1-0.0455)^{(16-0)}$$

$$= 1.1.(0.475)$$

$$= 0.475$$

[Ans:)

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(c) from, (a), we can say that, $P(x=1)$

So, we know,

$$P(x=1) = \frac{n!}{x!(n-x)!} \cdot p^x \cdot (1-p)^{(n-x)}$$

$$= \frac{16!}{1!(16-1)!} \cdot p^x \cdot (1-p)^t \quad \Big| n=16$$

$$= \frac{16!}{1!\,(16-1)!} \cdot (0.0455)^1 \cdot (1-0.0455)^{(16-1)}$$

$$= 16 \times 0.0455 \times 0.4973$$

$$= 0.3620$$ [Ans:]

d) Given, $\mu = 37$ kg

$\sigma = 0.4$ kg

by taking $x = 35.8$

$$Z = \frac{35.8 - 37}{0.4}$$

$$= -3$$

now, taking $x = 36.2$

$$Z = \frac{36.2 - 37}{0.4}$$

$$= -2$$

using Z Standard probability calculation,

$P(x > 36.2) = P(Z > -2) = 0.97725$

$P(x < 35.8) = P(Z < -3) = 0.00135$

So, Probability, $= P(x > 36.2) + P(x < 35.8)$

$= 0.97725 + 0.00135$

$= 0.9786$ Ans

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ANS TO THE QUESTION NO: - 07

Question no. 7

a. $P(x < 20) = (20-28)/8$

$= -8/8 = -1$

$P(z < -1)$ from standard normal table

$= 0.1587$

$P(x < 40) = (40-28)/8$

$= 12/8 = 1.5$

$P(z < 1.5)$ from standard normal table

$= 0.9332$

$P(20 < x < 40) = 0.9332 - 0.1587$

$= 0.7745$

Proportion of the duration is between 20 and 40 days old is 77.45 %

b. $P(X < 30) = (30-28)/8$

$= 2/8 = 0.25$

$P(z < 0.25)$ from standard normal table

$= 0.5987$

Proportion of the duration is less than 30 days old is 59.87 %

c. $P(z > x) = 0.75$

value of z to the cumulative probablity of 0.75 from normal table is -0.6745

$P(x-u/(s.d) > x - 28/8) = 0.75$

that is, $(x - 28/8) = -0.6745$

$x = -0.6745 * 8 + 28 = 22.6041$

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the number of days in wich 75% of all claims are above is at 22.6 - 23 days