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Spring ⇒ 24

Q1 (b) 3 → workers (A, B, C)

$P(A) = 0.7$

$P(B) = 0.8$

$P(C) = 0.6$

i) First worker : $1 - 0.7 = 0.3$

2nd Worker : $1 - 0.8 = 0.2$

3rd Worker : $1 - 0.6 = 0.4$

$P(\text{task won't complete}) = 0.3 \times 0.2 \times 0.4 = 0.024$

ii) $P(\text{every worker will complete}) = 0.7 \times 0.8 \times 0.6$

$= 0.336$

iii) $P(\text{Only 2nd Worker will complete the work})$

$= 0.3 \times 0.8 \times 0.4 = 0.096$

(1st worker fails to do. 3rd worker fails to do)

[Ans.]

c) $P(A) = \frac{25}{100}$

$P(B) = \frac{40}{100}$

$P(C) = \frac{25}{100}$

Efficiency = E

$P(E|A) = \frac{92}{100}$

$P(E|B) = \frac{97}{100}$

$P(E|C) = \frac{95}{100}$

$$P(B|E) = \frac{P(E|B)\,P(B)}{P(E|A)P(A) + P(E|B)P(B) + P(E|C)P(C)}$$

2nd programmer

= Do it yourself

(Ans)

Q2(a) hypergeometric distribution (since sampling done without replacement)

Formula $\frac{{}^{D}C_{K} \cdot {}^{N-D}C_{n-K}}{{}^{N}C_{n}}$

N = total no of item in population

$\therefore N = 50$

D = Total no of defective items = 5

n = sample size = 5

X = no of defective items

$P(x \leq 2)$

$= P(x=0) + P(x=1) + P(x=2)$

$$= \frac{{}^{5}C_0 \; {}^{45}C_{5-0}}{{}^{50}C_5} + \frac{{}^{5}C_1 \; {}^{45}C_4}{{}^{50}C_5} + \frac{{}^{5}C_2 \; {}^{45}C_3}{{}^{50}C_5}$$

$=$ Do it yourself

(Ans)

Q(5) $\Rightarrow$ (c) For normal distribution,

$$M_x(t) = \exp\left(\mu t + \frac{\sigma^2 t^2}{2}\right)$$

Mean $\mu = 24$

Variance, $\frac{1}{2}\sigma^2 = 50 \quad \therefore \sigma = 10$

S.D., $\sigma = \sqrt{50} = 5\sqrt{2}$

i) $P(Z \geq k) = 0.025$

$\Rightarrow 1 - P(Z \leq k) = 0.025$

$\Rightarrow P(Z \leq k) = 0.975$

$\Rightarrow \phi\left(Z < \frac{k-24}{10}\right) = 0.975$

$\Rightarrow \frac{k-24}{10} = \phi^{-1}(0.975)$

$\Rightarrow \frac{k-24}{10} = -1.96$

$\Rightarrow k - 24 = -19.6$

$\therefore k = 10.15$

(Ans.)

* ii) $P(x < 40.2)$

$= 1 - P(x > 40.2)$

$= 1 - P\left(z > \frac{40.2 - 24}{10}\right)$

$= 1 - \phi(1.62)$ (From table)

$= 1 - 0.9474$

$= 0.053$ (Ans)

ii) $P(x < 40.2)$

$= P\left(z < \frac{40.2 - 24}{16}\right)$

$= P(z < 1.62)$

$= \phi(1.62)$

$= 0.947$ (Ans)

Q4)

Null : $H_0 = \frac{26}{52} = 1/2$

Alternative : $H_a \neq 1/2$

$\alpha = 0.1$

Sample size, $n = 120$

$\mu = np = 120 \times 1/2$

$\sigma = \sqrt{npq}$

$= \sqrt{120 \times 1/2 \times 1/2}$

$\phi(z\alpha/2) = 1 - \alpha/2$

$= 1 - \frac{0.1}{2}$

$= 0.95$

$z\alpha/2 = \phi^{-1}(0.95) = 1.65$ (From table)

you have to find

$-z\alpha/2 \leq Z \leq -z\alpha/2$

.....

Do it yourself

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Fall ⇒ 23

Date: .....

Q(1) a) $S_1 = \{1, 2, 3, 4\}$

$S_2 = \{H, T\}$

	1	2	3	4
H	H1	2H	3H	4H
T	T1	T2	T3	T4

$P(A) = 2/4 = 1/2$

$P(B) = 1/2$

$P(A \cap B) = 2/4 = 1/2$

$P(A) \times P(B) = 1/2 \times 1/2 = 1/4$

$\therefore$ so independent.

b) $P(\text{algorithm will not be built}) = (1-0.48) \times (1-0.64) \times (1-0.55)$

$= 0.08424$

$\therefore P(\text{alg will be built}) = 1 - 0.084 = 0.916$

(Ans.)

Q2 (b)

$$E(1-3x^2)$$

$$= E(1) - 3E(x^2)$$

$$= 1 - 3E(x^2)$$

$$E(x^2) = \sum x^2 f(x)$$

$$= \{(1)^2 \times 0.35\} + \{2^2 \times 0.15\} + \{3^2 \times 0.05\} + \{(-1)^2 \times 0.45\}$$

$$= 0.35 + 0.60 + 0.45 + 0.45$$

$$= 1.85$$

$$\therefore E(1-3x^2) = 1 - (1.85 \times 3) = 1 - 5.55$$

$$= -4.55$$

(Ans)

c) Five sided dice : $X = \{1, 2, 3, 4, 5\}$

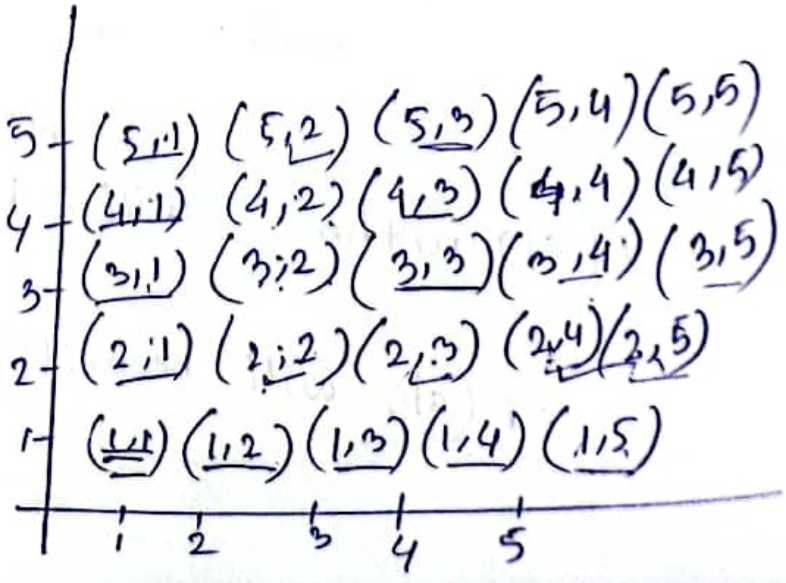
$P(x=1) = \frac{9}{25}$

$P(x=2) = \frac{7}{25}$

$P(x=3) = \frac{5}{25}$

$P(x=4) = 3/25$

$P(x=5) = 1/25$



$$pmf = \frac{11-2x}{25} \quad ; x = 1,2,3,4,5$$

9, 7, 5, 3, 1

$9 + (x-1)(-2)$

$= 2x - 2 + 9$

$= 11 + 7$

$= 9x - 2$

$= 9x + 7$

$9 - 2x + 2$

$-2x + 11$

c) $P(x=1) = P(x=2)$

$$\Rightarrow \frac{\lambda e^{-\lambda}}{1!} = \frac{\lambda^2 e^{-\lambda}}{2!}$$

$$\Rightarrow 1! = \frac{\lambda^2}{2}$$

$\lambda = 2$

$P(x<1) =$ for $P(x \le 1)$

$$= \frac{\lambda^x e^{-\lambda}}{x!}$$

$$= \frac{2^0 e^{-2}}{0!}$$

S.D. $= \sqrt{\lambda} = \sqrt{2}$ (Ans)

Q3 (b)

$$M_X(t) = \frac{e^{tb} - e^{ta}}{(b-a)t}$$

$$= \frac{e^{4t} - e^{0 \cdot t}}{4t}$$

Here, $b = 4$

$a = 0$

C.D.F

$$= \begin{cases} 0 & ; x < 0 \\ \frac{x-0}{4} & ; 0 \le x \le 4 \\ 1 & ; x > 4 \end{cases}$$

$$= \begin{cases} 0 & ; x \\ \frac{x-0}{4} & \end{cases}$$

$$= \begin{cases} 0 & ; x < 0 \\ x/4 & ; 0 \le x \le 4 \\ 1 & ; x > 4 \end{cases}$$

$p^x q^{n-x}$

Median : $m = \frac{a+b}{2}$

$= \frac{0+4}{2}$

$= \frac{4}{0} = 2$ (Ans.)

**Summer 2024

mean $= 160 = \mu$

SD $= 24 = \sigma$

$P(150 < X < 180) = P\left(\frac{150-160}{24} < Z < \frac{180-160}{24}\right)$

$= P(-0.416 < Z < 0.83)$

$= P(Z < 0.83) - P(Z < -0.416)$

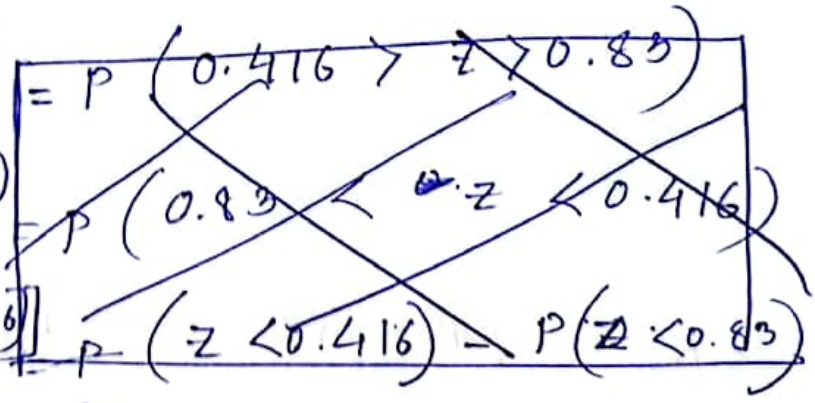
$= P(Z < 0.83) - P(Z > 0.416)$

$= P(Z < 0.83) - [1 - P(Z < 0.416)]$

$= P(Z < 0.83) + P(Z < 0.416) - 1$

$= 0.79673 + 0.66276 - 1$

$= 0.45949$ (Ans)



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*

$P(A) =$ ✓ Given

$P(B) =$ ✓ Given

$P(A \cap C) =$ ✓ Given

$P(A \cap B) = ?$

$P(C) = ?$

$P(B \cap C) = ?$

A, B, C independent

1) $P(A \cap B) = P(A) \times P(B)$

$= \square$

2) $P(B \cap C) = P(B) \times P(C)$

3) $P(A \cap C) = P(A) \times P(C)$

$P(C) = \frac{P(A \cap C)}{P(A)}$

$= \square$

*

To prob

binomial dist^n =>

What's the row of them will work =>

$P(X = 0) = {}^nC_x \, p^x \, q^{n-x}$

$H_0 = 4$

$H_a < 4$

$\mu = 6$

$\alpha = 0.05$

$z > -z_\alpha = 1 - 0.05$

$= 0.95$

$z < z_\alpha$

$\Phi(z_\alpha) = 0.95 = 1.65$ From table

$z_\alpha = 1.65$

$z > -z_\alpha$

$\Rightarrow \frac{\bar{x} - \mu}{\alpha} > -z_\alpha$

$\Rightarrow \bar{x} - \mu > -z_\alpha \times \alpha$

$\Rightarrow \bar{x} > \mu - (z_\alpha \times \alpha)$

$\bar{x} > 6 - (1.65 \times 0.$

$\mu = 6 \times 4 = 24$

$\alpha = \sqrt{6 \times 4 \times 3}$

$P + q = 1$

$4 + q = 1$

$q =$

$\Rightarrow$ Q3 (b)

Q2 (a)

$\Rightarrow$ x	1	2	3	4
$P(X=x)$	0.2	p	0.5	q

Given $E(x) = 2.5$;

Find a and b

$E(x) = 2.5$

$\Rightarrow \Sigma x P(x) = 2.5$

$\Rightarrow (1 \times 0.2) + 2p + (3 \times 0.5) + 4q = 2.5 \longrightarrow (1)$

sum of $\Longrightarrow$ probabilities will be 1.

$0.2 + P + q + 0.5 = 1 \longrightarrow (2)$

$\Downarrow$

solve (1) and (2) $\begin{cases} P = \\ q = \end{cases}$ (Ans.)