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CST Gp1

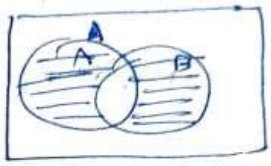
Home Assignment

Q1) Probability of occurrence of only one of the events A and B

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

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

$= P(A) + P(B) - 2P(A \cap B)$



Q2) 10% are defective, $p = 10\% = 0.1$ (defective)

$q = 1 - p = 0.9$ (non-defective)

$n = 20$

i) all are good bulbs. $\Rightarrow P(0)$

$P(0) = {}^{20}C_0 (0.1)^0 (0.9)^{20} = \boxed{0.121}$

ii) at most three are defective $\Rightarrow P(r \leq 3)$

$P(r \leq 3) = P[r=0] + P[r=1] + P[r=2] + P[r=3]$

$= (0.9)^{20} + {}^{20}C_1 (0.1)(0.9)^{19} + {}^{20}C_2 0.1^2 a9^{18}$

$+ {}^{20}C_2 0.1^3 a9^{17}$

$= 0.121 + 0.270 + 0.285 + 0.190$

$= \boxed{0.866}$

iii) exactly three are defective

$$P[X=3] = {}^{20}C_3 (0.1)^3 (0.9)^{17}$$

$$= \boxed{0.190}$$

Q3) $p = 0.01\% = 0.0001 \longrightarrow 0$

$n = 1000 \longrightarrow \infty$

$np = 0.1 \longrightarrow$ const

∴ we use poissim destribution with $\lambda = np = 0.1$

∴ probabiliy that more than two of it's clients. $\rightarrow P[X>2]$

$$P[X \geq 2] = 1 - P[X \leq 2]$$

$$= 1 - [P[X=0] + P[X=1] + P[X=2]]$$

$$= 1 - e^{-0.1} \left\{ \frac{(0.1)^0}{0!} + \frac{(0.1)^1}{1!} + \frac{(0.1)^2}{2!} \right\}$$

$$= 1 - e^{-0.1} \times 1.105$$

$$= \boxed{1.54 \times 10^{-4}}$$

Q4) ~~Poisson~~ Poission Parameter $\lambda = \frac{10}{50} = 0.2$

∴ Probability (3 or more) $\rightarrow P[X>3]$

$$P[X>3] = 1 - P[X \leq 2]$$

$$= 1 - [P(0) + P(1) + P(2)]$$

$$= 1 - e^{-0.2} \left\{ \frac{(0.2)^0}{0!} + \frac{(0.2)^1}{1!} + \frac{(0.2)^2}{2!} \right\}$$

$$= 1 - e^{-0.2} \times 1.22$$

$$= \boxed{0.00115}$$