SSG 413

Schaums

4.23 If the prob. that an individual will suffer a bad reaction from injection of a given serum is 0.001, determine the prob. that out of 2000 individuals, (a) exactly 3 (b) more than two individuals will suffer a bad reaction.

$p = 0.001, \quad q = 1 - p = 0.9999;$

$n = 2000$ (large)

(a) $Pr(X = 3)$

$X \sim Poisson(\lambda, n)$

$$P(X = x) = \frac{e^{-\lambda} \lambda^x}{x!}$$

$\lambda = E(X) = np = 2000 \times 0.001 = 2;$

$$P(X = 3) = \frac{e^{-2} 2^3}{3!} = 0.18045$$

Binomial

$P(X = x) = {}^{n}C_x \, p^x \, q^{n-x}$ — Binomial

$P(X = 3) = {}^{2000}C_3 \, (0.001)^3 \, (0.9999)^{1997}$

$$P(X>2) = P(X=3) + P(X=4) + \ldots + P(X=20$$

$$P(X \leq 2) + P(X>2) = 1$$

$$P(X>2) = 1 - P(X \leq 2)$$

$$P(X \leq 2) = P(X=0) + P(X=1) + P(X=2)$$

$$= \frac{e^{-2} \cdot 2^0}{0!} + \frac{e^{-2} 2^1}{1!} + \frac{e^{-2} 2^2}{2!}$$

$$= 5e^{-2}$$

$$P(X>2) = 1 - 5e^{-2}$$

$$= 0.323$$

Schaums

'What is the probability of getting a total of 9 @twice ⓑ at least twice, in 6 tosses of a pair of dice?

Solutions :-

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

1000 forms of

P_r(Sum of 9) $= p = 4/36 = 1/9$;

$q = 1 - \frac{1}{9} = 8/9$

'X ~ RV of total of 9;

$P_r(X=2) = \binom{n}{x} p^x q^{n-x}$; $n = 6$;

$x = 2$

$P(X=2) = \binom{6}{2}\left(\frac{1}{9}\right)^2\left(\frac{8}{9}\right)^4$

$= 0.116$

ⓑ P(at least twice) $= 1 - P$(at most twice).

$P(X \geq 2) = 1 - P(X < 2)$

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

$= 1 - \left(\binom{6}{0}\left(\frac{1}{9}\right)^0\left(\frac{8}{9}\right)^6 + \binom{6}{1}\left(\frac{1}{9}\right)^1\left(\frac{8}{9}\right)^5\right)$

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