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Assignment-2

Problems from Chapter 3.

3.7 given baseball game is a random variable with distribution.

x	0	1	2
$P(x)$	0.4	0.4	0.2

Let Y be the total number of home runs

$E(Y) =$

They played two game and are independent to each other

$P_Y(0) = P\{Y=0\} = P\{X_1 = X_2 = 0\}$
$= P(X_1=0) * P(X_2=0)$
$= P_1(0) P_2(0)$
$= (0.4)(0.4) = 0.16$

$P_Y(1) = [P(X_1=0) * P(X_2=1)] + [P(X_1=1) * P(X_2=0)]$
$= (0.4 * 0.4) + (0.4 * 0.4)$
$= 0.16 + 0.16 = 0.32$

$P_Y(2) = P(Y=2)$
$= [P(X_1=0) * P(X_2=2)] + [P(X_1=1) * P(X_2=1)]$
$+ [P(X_1=2) * P(X_2=0)]$
$= (0.4 * 0.2) + (0.4 * 0.4) + (0.2 * 0.4)$
$= 0.08 + 0.16 + 0.08$
$= \underline{0.32}$

$P_Y(3) = P(Y=3)$
$[P(X_1=1) * P(X_2=2)] + [P(X_1=2) * P(X_2=1)]$
$= (0.4 * 0.2) + (0.2 * 0.4)$
$= \underline{0.16}$

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$P(Y=4) = P(X_1=2) * P(X_2=2)$
$0.2 * 0.2$
$= 0.04.$

$E(Y) = \Sigma_y\, y * P(y)$

$E(Y) = (0*0.16) + (1*0.32) + (2*0.32) + (3*0.16) + (4*0.04)$
$= 0 + 0.32 + 0.64 + 0.48 + 0.16$
$= \underline{1.60}$

$Var(Y) = \Sigma_y (y - E(y))^2 * P(y)$
[variance formula].

$[(0-1.6)^2 * 0.16] + [(1-1.6)^2 * 0.32] + [(2-1.6)^2 * 0.32] + [(3-1.6)^2 * 0.16] + [(4-1.6)^2 * 0.04]$
$\Rightarrow (2.56*0.16) + (0.36*0.32) + (0.16*0.32) + (1.96*0.16) + (5.76*0.04)$
$\Rightarrow 0.4096 + 0.1152 + 0.0512 + 0.3136 + 0.2304$
$\Rightarrow \underline{\underline{1.12}}.$

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3.21 The total number of computer that are attacked by a Computer virus = 20
The probability that it entered at least 10 computers are $p(x \geq 10)$,
from the binomial distribution we have

$$P(x) = p\{X = x\} = \binom{n}{x} p^x q^{n-x}, \quad x = 0, 1 \ldots, n$$

$$P(x \geq 10) = 1 - p(x \leq 9)$$
$$1 - p(0) \cdot p(1) - p(2) \cdot \ldots$$
$$1 - \sum_{x=0}^{9} {}^nc_x p^x q^{n-x}$$

$$p(x \geq 10) = \sum_{x=10}^{20} {}^nc_x p^x q^{n-x}.$$

From the Binomial table,
$$p(x \geq 10) = 1 - p(x \leq 9)$$
$$\Rightarrow 1 - F(9)$$
$$= 1 - 0.755$$
$$= \underline{0.245}$$
$$p(x \geq 10) = 0.245.$$

The probability that it entered at least 10 computer = $\underline{0.245}$

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3.22 Parts produced by a certain Supplier are defective = 5% = 0.05

$p = 0.05$.

No of Sample parts = 16

$n = 16$.

The parts containing defective are = 3.

$P(x) = P\{X = x\} = \binom{n}{x} p^x q^{n-x}, \quad x = 0, 1 \ldots 16.$

∴ Binomial distribution.

$P(x > 3) = 1 - P(X <= 3)$

[probability that there are more than 3 defective according to the problem]

∴ from the bionomial distribution value table

$= 1 - 0.0993$

$= \underline{0.007}$

The probability that a Sample of 16 parts contains more than 3 defective ones are => $\underline{0.007}$.

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3.31 probability of components pass this inspection is 80% = $P = 0.80$.

(a) Probability that at least 18 of the next 20 components pass inspection.
from it we can have q

$$q = 1 - P$$
$$q = 1 - 0.80 = 0.20$$
$$q = \underline{0.20}$$

The probability of at least 18 of 20 are passing inspection is given by

$$P(x \geq 18) = p(x = 18) + p(x = 19) + P(x = 20).$$

we can also change the equation.

$$P(x \geq 18) = 1 - P(x < 18)$$
$$1 - (P(x=0)) + (P(x=1)) + (P(x=2)) + (P(x=3))$$
$$+ \ldots + (P(x=18))$$

$$\Rightarrow 1 - (0.7935)$$

$\therefore$ 0.7939 is taken from the binomial table.

$$\Rightarrow P(x > 18) = 0.2061$$

(b) the average components that should be inspected until a component passes inspection is $\frac{1}{P} = \frac{1}{0.80} = 1.025$

[$\because$ through geometric progression].

$\therefore$ Hence 1.25 components should be inspected until a component that passes inspection.

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3.36 The total number of System that are connected to the central computer = 10.
The probability to transmit a message = 0.7
The probability that Exactly 6 terminals are ready to transmit at 8 o'clock:

$$P(x=6) = \binom{10_C}{6} (0.7)^6 (1-0.7)^{10-6}$$

$$= \frac{10!}{6!(10-6)!} (0.7)^6 (0.3)^4$$

$$= \frac{10 \times \cancel{9}^{3} \times \cancel{8} \times \cancel{7}^{7} \times \cancel{6!}}{\cancel{6!} \cdot \cancel{4} \times \cancel{3} \times \cancel{2} \times 1} \times 0.117649 \times 0.00081$$

$\Rightarrow 210 \times 0.117649 \times 0.0081$

$\Rightarrow \underline{0.2001}$

0.02001 is the probability to transmit 6 terminals at 8 o'clock.

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Problem on Hypergeometric Distribution.

Number of narcotic tablets in a bottle = 6. ⇒ m = 6

Number of vitamin tablets in a bottle = 9.

Number of tablets selected by the customs official = 3. ⇒ n = 3.

Total number of tablets in the bottle = 15

N = 15.

N = 15, m = 6 and n = 3.

we know,

$h(x, N, n, m) =$

$$p(x=0) = \frac{({}^{m}C_{x})({}^{N-m}C_{n-x})}{{}^{N}C_{n}}$$

$$\Rightarrow \frac{({}^{6}C_{0})({}^{9}C_{3})}{{}^{15}C_{3}}$$

$$\Rightarrow \frac{\cancel{6!} \times 9! \times 12! \times \cancel{3!}}{\cancel{6!} \times 6! \times \cancel{3!} \times 15!}$$

$$= \frac{\cancel{9! \times 12! \, 6!}}{\cancel{6! \times 15!}} \quad \frac{9! \times 12!}{6! \times 15!}$$

$$\frac{9 \times 8 \times 7 \times \cancel{12!}}{15 \times 14 \times 13 \times \cancel{12!}}$$

$$\frac{504}{2730} = 0.1846$$

$P(x \geq 1) = 1 - P(X=0)$

$= 1 - 0.1846$

$= 0.8154$