YASH GUPTA 2019BTCS088 STATISTICS-II (MST-I)

BTCS04CFA2 01:00PM - 02:00PM

05/02/2021

Section-01

Q2

Sol^n (2): The mean Number of mistakes

Given that: Total No of days = 300

$$= \frac{1}{300}\{143*0 + 90*1 + 42*2 + 12*3 + 9*4 + 3*5 + 1*6\}$$

$$= \frac{1}{300}\{90 + 84 + 36 + 36 + 15 + 6 + 0\} = \frac{267}{300} = 0.89$$

$\therefore$ $\boxed{\text{Mean} = 0.89}$

No. of mistakes	Probability $P(r) = \frac{e^{-0.89} * (0.89)^r}{r!}$	Theoritical frequency $= P(r) * \text{Mean}$
0	$\frac{e^{-0.89} * (0.89)^0}{0!} = 0.411$	$0.411 * 300 = 123.3 \approx 123$
1	$\frac{e^{-0.89} * (0.89)^1}{1!} = 0.365$	$0.365 * 300 = 110$
2	$\frac{e^{-0.89} * (0.89)^2}{2!} = 0.163$	$0.163 * 300 = 48.9 \approx 48$
3	$\frac{e^{-0.89} * (0.89)^3}{3!} = 0.048$	$0.048 * 300 = 14.4 \approx 14$
4	$\frac{e^{-0.89} * (0.89)^4}{4!} = 0.011$	$0.011 * 300 = 3.3 = 3$
5	$\frac{e^{-0.89} * (0.89)^5}{5!} = 0.002$	$0.002 * 300 = 0.6 = 1$
6	$\frac{e^{-0.89} * (0.89)^6}{6!} = 0.0003$	$0.0003 * 300 = 0.09 = 0$

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Section-II

Q3

Sol^n 3: In a binomial distribution consisting of 5 independent trials
$\hookrightarrow \boxed{n=5}$

The probability of 1 and 2 successes are 0.4096 and 0.2048 respectively.

$\hookrightarrow$ We know the Binomial distribution formula
$\hookrightarrow$ i.e: $P[X=x] = {}^nC_x\, p^x q^{n-x}$

Putting values provided above, then:

$P[X=1] = 0.4096$ {Given that}
$P[X=2] = 0.2048$ {— " —}

Now, using formula, we get
$P[X=1] = {}^5C_1\, p^1 (1-p)^4$ — ① eq^n
$P[X=2] = {}^5C_2\, p^2 (1-p)^3$ — ② eq^n

①/② eq^n
$$\Rightarrow \frac{0.4096}{0.2048} = \frac{{}^5C_1}{{}^5C_2}\,\frac{p}{p^2}\,\frac{(1-p)^4}{(1-p)^3}$$

$$\Rightarrow \frac{2}{1} = \frac{5}{10}\,\frac{(1-p)}{p}$$

$$\Rightarrow 2 = \frac{(1-p)}{2p}$$

$$4p = 1-p$$

$$5p = 1$$

$$\Rightarrow \boxed{p = \frac{1}{5}}$$

Therefore, The probability p of the distribution $= \boxed{\frac{1}{5}}$

—x—

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Section - 03

Qs:

Sol^n ③ Let X be a random variable which denotes the No. of demands for a car on any day.

Therefore, 'X' is Poisson Distribution with the parameter $\boxed{\mu = 1.5}$

Hence, the probability mass function is

$$P[X=i] = \frac{e^{-\mu}\mu^{i}}{i!} = \frac{e^{-1.5}(1.5)^{i}}{i!} \quad ; \{\text{Here}, i = 0, 1, 2\}$$

Now, acc. to question,

the proportion of days in which NEITHER CAR IS USED is actually the probability of there being No demand ~~of~~ cars which is given by

$$\Rightarrow \quad P[X=0] = \frac{e^{-1.5}(1.5)^{0}}{0!} = e^{-1.5} = 0.2231$$

And, when the proportion of days on which some demand is refused, is the the probability that the number of demands become more than 2 is given by :

$$P[X>2] = 1 - P[X \le 2]$$

$$= 1 - \{P[X=0] + P[X=1] + P[X=2]\}$$

$$= 1 - \left[\frac{e^{-1.5}(1.5)^{0}}{0!} + \frac{e^{-1.5}(1.5)^{1}}{1!} + \frac{e^{-1.5}(1.5)^{2}}{2!}\right]$$

$$= 1 - e^{-1.5}\left[1 + 1.5 + \frac{2.25}{2}\right]$$

$$= 1 - e^{-1.5}\left[\frac{2.5\times2 + 2.25}{2}\right]$$

$$= 1 - e^{-1.5}\left[\frac{5+2.25}{2}\right] = 1 - e^{-1.5}\left(\frac{7.25}{2}\right)$$

$$= 0.1912$$

∴ Proportion of days on which Neither car is used $= e^{-1.5} \approx 0.2231 \simeq 22.31\%$.

& proportion of days on which some demand is refused $= 0.1912 \approx 19.12\%$.

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Section-04

Q6

Sol^n 6: Characteristics of Normal curve: →

$y = y_0 e^{-\frac{x^2}{2a^2}}$

1. The curve is symmetrical about the Y-axis.
   The mean, median & mode coincide at the origin.

2. The curve is drawn, if mean and standard deviation are given.
   The value of y_0 can be calculated {origin of x} from the fact that the area of the curve must be equal to the total No. of observation.

3. 'y' decreases rapidly as 'x' increases Numerically. The curve extends to ∞ on either side of the origin.

———→———

Q7

Sol^n 7 :- Assuming the dice thrown is a 6 sided dice {as Fair Dice}

~~(1) Chance that either an even Number~~

(1) Probability to get even No:– Dice = 6 sides / chance

Even No = 3

$P(\text{Even No}) = \frac{3}{6} = \frac{1}{2}$

Now, Probability to get a No. Greater than 3 ⇒ {4, 5, 6} = S sample space

↳ $P(N>3) = \frac{3}{6} = \frac{1}{2}$

Note: There are 2 No's common which are Even as well as Greater than 3

those are 4 & 6

$P(\text{Common No}) = \frac{2}{6} = \frac{1}{3}$

Hence, Probability of (Even No. or >3)

$= \frac{1}{2} + \frac{1}{2} - \frac{1}{3} = \frac{4}{6} = \frac{2}{3}$ Ans

& the chance of (Even No or >3) = $\frac{2}{3} * 100 = \boxed{33.33\%}$

———x———

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Q8

Sol8. Given that ; $P = 0.001$, $n = 2000$

$m = np = 0.001 * 2000$ ↩ {Mean = np}

$\boxed{m = 2}$

& Exactly 3 {three will suffer}

$X = 3$

So, By Poisson Distribution ,

$$P[X = x] = \frac{e^{-m} m^x}{x!}$$

$$P[X = 3] = \frac{e^{-2} (2)^3}{3!} = \frac{e^{-2}\, 8}{6} = \frac{e^{-2}\, 4}{3} = \frac{4}{3e^2}$$

$$= \frac{4}{3 * 1.22}$$

$\boxed{= 1.0928}$ Ans

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