(1)

Distribution Assignment

(2) Average Monthly Sales of 2000 firms are normally distributed. $\mu = 38000$ $\sigma = 10\,000$

(i) Firms with sales over 50000.

$x = 50000$ $\mu = 38000$ $\sigma = 10000$

$\boxed{N.D = Z = \frac{x-\mu}{\sigma}} = \frac{12000}{10000} = 1.2.$ $(Z > 1.2 = ?)$

$Z > 1.2\sigma$ } $1.2\sigma = 0.89.$ $\therefore P(\text{Sales} > 50000) = 1 - 0.89 = 0.11$ }

No of firms $= P(\,)\cdot 2000 = \underline{\underline{220}}$

~~(ii)~~

(ii). % of firms with sales b/w 38500 & 41000

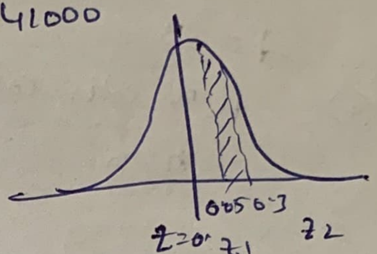
$Z_1 = \frac{38500 - 38000}{10000} = 0.05$

$Z_2 = \frac{41000 - 38000}{10000} = 0.3.$

$P(0.05) = 0.5199$
$P(0.3) = 0.6179.$ } Area $= (Z_2 - Z_1)$

$= 0.6179 - 0.5199$

$= 0.098 = \approx 9.8\%.$



(iii) No of firms with sales b/w 30000 & 50000

$Z_1 = \frac{30000 - 38000}{10000} = \frac{-8000}{10000} = -0.8$

$Z_2 = \frac{50000 - 38000}{10000} = \frac{12000}{10000} = 1.2$

$P(Z_1) = 0.2119$
$P(Z_2) = 0.8468$

$\therefore$ Area $= P(Z_2 - Z_1) = 0.8468 - 0.2119$
$= 0.6342 \approx 63.42\%$

$\therefore$ No of firms $= \frac{(63.42)\times 2000}{100} = \underline{1268}$

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(3) Test = 20 MCQ. (4 option for each Q)

P(5 wrong answers). n = Total answers. = 20.

Binomial

r = Success 5 wrong

$\therefore$ 15 correct = r (success)

$\boxed{{}^{n}C_{r}\, p^{r} q^{n-r}}$

$p = P(\text{wrong}) = \frac{5}{20} = 1/4.$

$q = P(\text{right}) = \frac{15}{20} = 3/4.$

$\boxed{\therefore P = {}^{20}C_{15} (1/4)^{15} (3/4)^{5}}$

(4) Avg. rate of photons reaching the telescope is 4/sec.

P(no photon reaches the telescope in a given second) = ?

$\lambda = 4$. (Poisson random variable, mean),

$\boxed{r=0}$

PMF = $P(X=r) = \dfrac{e^{-\lambda} \cdot \lambda^{r}}{r!}$. $P = \dfrac{e^{-4} \cdot 4^{0}}{0!} = e^{-4}$.

r = required no of times.

(5) $\lambda = 3$.

(a) P(no calls come in a given 1-minute period)

$r=0$. $P = \dfrac{e^{-\lambda} \cdot \lambda^{r}}{r!} = \dfrac{e^{-3} \cdot 3^{0}}{0!} = e^{-3} = 0.0497$
$= 4.97\%$

(b) P(at least two calls will arrive in a given 2-min period) = ?

$r = 2$. $\lambda = 3$/minute $\left\{ \begin{array}{l} 1\text{ min} = 3 \\ 2\text{ min} = 6. \end{array} \right\}$

$\therefore \lambda/2\text{min} = 3 \times 2 = 6$.

$\therefore P = \boxed{\dfrac{e^{-6} \cdot 6^{2}}{2!}} = 0.044617$

P(...) = ' Probability (at least 2)

$\therefore P(r \geq 2) = 1 - 0.044675 = 95.53\%$

(6)

20% defective rate in a production line.

(6) P(obtaining the first defected part after three good parts) = ?

→ $P(\text{defect}) = \dfrac{20}{100} = 1/5 = 0.2$

$P(\text{good}) = \dfrac{80}{100} = 0.8$

$\left.\right\}$ $\left\{ \begin{array}{l} p = 0.2 \\ q = 0.8 \end{array} \right\}$

$P(x=4) = \underline{G\ G\ G\ D}$ $= 0.1024$
$0.8\ 0.8\ 0.8\ 0.2$ $= 10.24\%$

Avg. No of inspections to obtain the first defect = ?

$P(d) = 1/5$ i.e one in 5

$\therefore$ for every 5 items, we can find one defect

$\therefore$ Ans (5)

(2)

(7) P(Student is accepted to a Prestigious college) = 0.3.

If 5 students apply from the same school,

P(at most 2 got accepted)

$P(S) = 0.3 \quad P(NS) = 0.7.$

$P(r \le 2) = \sum_{i=0}^{r} nC_i \, p^i \, q^{n-i}$

$n = 5$

$r = 2$

$= \Rightarrow \left(5C_0 (0.3)^0 \cdot (0.7)^{5-0}\right) + \left(5C_1 (0.3)^1 (0.7)^4\right) + \left(5C_2 (0.3)^2 (0.7)^3\right)$

$P(X \le 2) = 0.8361$

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(8) Max wey = 800 kg.

$\mu = 70 \quad \sigma^2 = 200. \quad \sigma = \sqrt{200} = 10\sqrt{2}.$

$n = 10$

(i) $Z = \frac{x - \mu}{\sigma} = \frac{800 - (70 \times 10)}{10\sqrt{2}} = 2.23$

$P(Z < 2.23) = 0.9871 = 98.71\%$

$n=12.$

(ii) $P(12) = \frac{800 - (70 \times 12)}{\frac{(10\sqrt{2}).12}{\sqrt{12}}} = \frac{-40}{(1.414)(10\sqrt{12})} = -0.82$

$P(Z < -0.82) = 0.2061 = 20.61\%$

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(9) $n = 50$ 2 Choices each Q.

(a) (i) $x = 20$. $P = nC_x \, p^x q^{n-x}$

$P(\text{corr}) = 1/2$

$P(\text{wr}) = 1/2$

$P(x = 20) = 50C_{20} (1/2)^{20} (1/2)^{50-20}$

$= 0.04185 = 4.18\%$

(b) If ch = 4

$p = 1/4$

$q = 3/4.$

$\boxed{P(20) = 50C_{20} (1/4)^{20} (3/4)^{50-20}}$

$= \boxed{0.76\%}$ //

(10) $P(\text{fault}) = \frac{30}{100} = 0.3$.

$P(\text{Xactly } 2 = \text{defect})$, randomly $= 6$

$P(NF) = \frac{70}{100} = 0.7$ $\left.\begin{matrix} n=6 \\ r=2 \end{matrix}\right\}$.

$P(X=2) = {}^{n}C_{r} (p)^{r} q^{n-r} = {}^{6}C_{2} (0.3)^{2} (0.7)^{4}$,

$(\because \mu = np)$

$= 0.32418$

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(11) . For a conitee, 6 errors per hour enters 77 /min)

P(2 errors in 322 word report) $\left.\begin{matrix} P(er) = 6/60 = 0.1; \\ P(\text{no } er) = 1 - 0.1 = 0.9 \end{matrix}\right\}$

$\lambda = 6/hr$. $r = 2$ $\lambda = 0.1$

$P(X=2) = \frac{e^{-0.1} (0.1)^{2}}{2!}$

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