Distribution Assignment

2) $\mu = 38,000$
$\sigma = 10,000$
$n = 2,000$

i) no. of sales of over Rs 50,000
$x = 50,000$

$$Z\ score = \frac{50,000 - 38,000}{10,000}$$
$$= \frac{12,\cancel{000}}{10,\cancel{000}} = 1.2$$

area $= 0.8849$
Required area $= 1 - 0.8849$
$= 0.1151$
$= 11.51\%$

$$= \frac{11.51}{1\cancel{00}} \times 2,0\cancel{00}$$
$$= 230.2$$

ii) %-age of ~~first~~ firms with sales between 38,500 and

$$Z_1\ score = \frac{38500 - 38000}{10000}$$
$$= \frac{1\cancel{500}}{\cancel{1}\cancel{0000}\ 20} = \cancel{0.5}\ 0.05$$

$$Z_2\ score = \frac{41000 - 38000}{10000}$$
$$= \frac{3\cancel{000}}{1\cancel{0000}} = 0.3$$

area $= \cancel{0.6179}\ 0.5199$
Required area $= 1 - \cancel{0.6179}\ 0.5199$
$= \cancel{0.3821}\ 0.4801$
$\cancel{\simeq 0.38} \simeq 0.48$

area $= \cancel{0.3}\ 0.6179$
Required area $= 1 - 0.6179$
$= 0.3821$
$\simeq 0.38$

Required area $= 0.48 - 0.38 = 0.10 = 10\%$.

No. of firms $= \frac{10}{1\cancel{00}} \times 20\cancel{00} = 200$

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iii) Number of firms with sales between 30,000 and 50,000

From ⓘ

Required area for $x = 50{,}000$
$= 0.1151 \simeq 0.12$

$$Z\text{score} = \frac{30{,}000 - 38{,}000}{10{,}000}$$

$$= \frac{\cancel{48000}}{\cancel{10000}_{5}} = -0.8$$

area $=$ ~~0.7881~~ 0.2119

Required area $= 1 - 0.2119$
$= 0.7881 \simeq 0.79$

Required area $= 0.79 - 0.67$
$= 0.67$
$= 67\%$

No. of firms $= \frac{67 \times 20\cancel{00}}{1\cancel{00}} = 1340$

3) $n = 20$
$r = 5$

Let the wrong answer be a success

$p = 3/4,\ q = 1/4$

$$P(5) = {}^{20}C_5 \left(\frac{3}{4}\right)^5 \cdot \left(\frac{1}{4}\right)^{15}$$

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mean = 4 photons / sec

using Poisson's distribution

$\lambda = 4, r = 0$

$$p(0) = \frac{e^{-4} \times 4^0}{\lfloor 0}$$

$$= \frac{e^{-4} \times 1}{1} = e^{-4}$$

5) mean = 3 calls / ~~5~~ min

a) $\lambda = \cancel{0}3, r = 0$

$$P(0) = \frac{e^{-3} \times 3^0}{\lfloor 0}$$

$$= \frac{e^{-3} \times 1}{1} = e^{-3}$$

b) λ = 3 calls / min

= 6 calls / min

$r \geq 2$

$$CMF = P(r \geq 2) = P(r=2) + P(r=3) + P(r=4) + \cdots + P(r=\infty)$$

$$= 1 - P(0) + P(1) + \cancel{p}$$

$$= 1 - \frac{e^{-6} \times 6^0}{\lfloor 0} + \frac{e^{-6} \times 6^1}{\lfloor 1}$$

$$= 1 - [e^{-6} + e^{-6} \times 6]$$

$$= 1 - e^{-6}(1+6)$$

$$= 1 - 7e^{-6}$$

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ii 6) P(defective) = 0.2

P(non-defective) = 1-0.2
= 0.8

$n = 4$

$r = 1$

~~let a defective~~

let getting a defective item be the success

$$P(r=1) = {}^4C_1\,(0.2)^1.\,(0.8)^3$$

7) P(acceptance) = 0.3

$n = 5$

$r = 2$

P(non-acceptance) = 1-0.3
= 0.7

let a student be accepted be the success

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

$$= {}^5C_0\,(0.3)^0.(0.7)^5 + {}^5C_1.(0.3)^1.(0.7)^4 + {}^5C_2.(0.3)^2.(0.7)^3$$

8) mean = 70, ~~x = 200~~ variance = 200

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9) $n = 50$

$r = 7/20$

let answering a question correctly be the success

$p = \frac{1}{2}$, $q = \frac{1}{2}$

$$P(7\cap 20) = \sum_{i=0}^{20} {}^{50}C_i \left(\frac{1}{2}\right)^i \cdot \left(\frac{1}{2}\right)^{50-i}$$

If each question had 4 choices:

$$P(7\cap 20) = \sum_{i=20}^{50} {}^{50}C_i \cdot \left(\frac{1}{4}\right)^i \cdot \left(\frac{1}{4}\right)^{50-i}$$

10) P(defective) = 0.3

P(non-defective) = 0.7

$n = 6$

$r = 2$

let ~~the~~ getting a defective item be the success

$$P(2) = {}^6C_2 \cdot (0.3)^2 \cdot (0.7)^4$$

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11) $\lambda = 6$ errors per hour

77 words/min $= 0.1$ error/min $= 0.418$ errors/4.18 min

322 words $= 4.18$ min

$r = 2$

$$P(2) = \frac{e^{-0.418} \times (0.418)^2}{\lfloor 2}$$

$$= \frac{e^{-0.418} \times (0.418)^2}{2}$$

12) P(high dioxin) = 0.05

P(low dioxin) = q 0.95

$n = 20$, let site with high dioxin be the success

a) ~~$P(7/1) = \sum_{i=1}^{i=20} {}^{20}C_i (0.05)^i . (0.95)^{20-i}$~~

b) $P(\leq 1) = P(0) + P(1)$

$= {}^{20}C_0 (0.05)^0 . (0.95)^{20} + {}^{20}C_1 . (0.05)^1 . (0.95)^{19}$

a) $P(<1) = P(0)$

$= {}^{20}C_0 (0.05)^0 . (0.95)^{20}$

$= (0.95)^{20}$

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

$= (0.95)^{20} + {}^{20}C_1 (0.05)^1 . (0.95)^{19} + {}^{20}C_2 (0.05)^2 . (0.95)^{18}$

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13) $P(\text{audit}) = 0.5$

a) let the company being audited be the success

$$P(=2) = {}^{5}C_2 \cdot (0.5)^2 \cdot (0.5)^3$$

b)
$$P(=2) = {}^{2}C_2 \cdot (0.5)^2 \cdot (0.5)^0$$
$$= \frac{\lfloor 2}{\lfloor 2 \cdot \lfloor 0} \cdot (0.5)^2 \cdot 1$$
$$= \frac{\cancel{2!}\,1}{1\,\cancel{2!}\cdot 0!} (0.5)^2$$
$$= 0.25$$

c)
$$P(\geq 1) = 1 - P(0)$$
$$= 1 - {}^{4}C_0\,(0.5)^0 \cdot (0.5)^4$$
$$= 1 - (0.5)^4$$

14) $P(\text{stopping at traffic}) = 0.2$

let stopping at a traffic light be the success

a) $P(2) = {}^{15}C_2\,(0.2)^2 \cdot (0.8)^{13}$

b)
$$P(\geq 1) = 1 - P(0)$$
$$= 1 - {}^{15}C_0 \cdot (0.2)^0 \cdot (0.5)^{15}$$
$$= 1 - (0.5)^{15}$$

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