DISTRIBUTION ASSIGNMENT

2. $\mu = 38000$ $\quad n = 2000$

$\sigma = 10000$

a) $x > 50{,}000$

$$z = \frac{50{,}000 - 38{,}000}{10{,}000} = 1.2 \overset{z}{\Rightarrow} 0.8849$$

$$P(x > 50000) = 1 - 0.8849 \Rightarrow 0.1151$$

b) $38{,}500 < x < 41{,}000$

$$z_1 = \frac{38{,}500 - 38{,}000}{10{,}000} = 0.05 \overset{z}{\Rightarrow} 0.5199$$

$$z_2 = \frac{41{,}000 - 38{,}000}{10{,}000} = 0.3 \Rightarrow 0.6179.$$

$$\therefore P(38{,}500 < x < 41{,}000) \Rightarrow 0.6179 - 0.5199$$

$$\Rightarrow 0.098$$

c) $30{,}000 < x < 50{,}000$

$$z_1 = \frac{30{,}000 - 38{,}000}{10{,}000} = -0.8 \overset{z}{\Rightarrow} 0.2119$$

$$z_2 = \cancel{0.1151}\ 0.8849$$

$$\therefore P(30{,}000 < x < 50{,}000) = 0.673 \times 2000 \Rightarrow 1346$$

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3. $n = 20$ $\quad r = 5$ wrong answer

$p = 3/4$ $\quad$ Since r is wrong, pbty of success should be wrong answers.

$q = 1/4$

$$P(X=r) = {}^{n}C_{r}\, p^{r} q^{n-r}$$

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

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4. $\lambda = 4$ photons/sec

$P(x=0) = ?$

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

$$= \frac{e^{-4}\times 4^{0}}{0!}$$

$$= 0.0183$$

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5. $\lambda = 3$

a) No. of calls in 1 minute period.

$x = 0$

$$P(X=0) = \frac{3^{0}\times e^{-3}}{0!} = e^{-3} = 0.049$$

b) Pbty. that atleast calls arrive in 2-minute period.

$$P(x<2) = P(x=0) + P(x=1) + P(x=2)$$

$$= 0.049 + \frac{3^{1}\times e^{-3}}{1!} + \frac{3^{2}+e^{-3}}{2!}$$

$$= e^{-3}\left[1+3+\frac{9}{2}\right]$$

$$= 0.049 \times 8.5$$

$$= 0.423$$

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6. $q = 20\% = \cancel{q.2}\ 0.8$ Since we need to find first failure p would the defective rate 0.2.

$p = \cancel{q.8}\ 0.2$

Geometric distribution for modelling number of failures till first success.

$$P(Y=k) = (1-p)^k \, p$$

$$P(Y=k) = (0.8)^3 (0.2)$$

$$= 0.1024$$

$$\text{Avg} \Rightarrow 1/p = \frac{1}{0.1024} = 9.76$$

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7. Atmost 2 ; ≤ 2

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

$$= 5C_0 (0.3)^0 (0.7)^5 + 5C_1 (0.3)^1 (0.7)^4 + 5C_2 (0.3)^2 (0.7)^3$$

$$= \frac{5!}{0!\,5!} \times (0.7)^5 + \frac{5!}{1!\,4!} (0.3)^1 (0.7)^4 + \frac{5!}{2!\,3!} (0.3)^2 (0.7)^3$$

$$= (0.7)^3 \left[(0.7)^2 + \cancel{\frac{5!}{4!}}\ 5 \times 0.3 \times 0.7 + 10 \times 0.3 \times 0.3 \right]$$

$$= 0.343 \times (0.49 + 1.05 + 0.9)$$

$$= 0.83692$$

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8. $\mu = 70$

$\sigma^2 = 200 \quad \therefore \quad \sigma = 14.14$

a) For 10 adults.

$\cancel{\mu x} \quad x = \frac{800}{10} = 80$

$$z = \frac{80-70}{\cancel{200}\ 14.14/\sqrt{10}} = \frac{10}{4.47} = (2.23) \xRightarrow{z}$$

8. $\mu = 70$

$\sigma^2 = 200$

a) For 10 adults;

$\mu = 70 \times 10 = 700$

$\sigma^2 = 200 \times 10 = 2000$

$$z = \frac{800 - 700}{\sqrt{2000}} = \frac{100}{\cancel{\sqrt{44.72}}\ 44.7} = (2.23) \xRightarrow{z}$$

$\Rightarrow \ 0.98713$

b) $P(x = 12)$

$\mu = 70 \times 12 = 840$

$\sigma^2 = 200 \times 12 = 2400$

$$= \frac{800 - 840}{\sqrt{2400}} = -0.816 \xRightarrow{z} 0.7910$$

9. $p = \frac{1}{2}$

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

$n = 50.$

atleast 20, ≥ 20

$\therefore P(x \geq 20) = 1 - P(x < 20)$

$= 1 - (P(x=0) + \dots P(x=19))$

~~10~~. b) If 4 choices.

$p = 1/4$

$q = 3/4$

$r = 20$

$P(x \geq 20) = 1 - P(x < 20)$

$= 1 - (P(x=0) + \dots P(x=19))$

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10. $p = 0.3$

$q = 0.7$

$n = 6$

Binomial dist;

$P(x=2) = 6C_2 (0.3)^2 \times (0.7)^4$

$= \frac{6!}{4!\,2!} \times 0.09 \times 0.2401$

$= 0.324$

11. No. of words $= 77$ words/min

No. of errors $= 6$ errors/hr

in min $= \frac{6}{60} = 0.1$/min

prob of 2 errors in 322 word

Time for 322 words $= \frac{322}{77} = 4.18$ min

$$P(x=2) = \frac{e^{-\lambda}\lambda^x}{x!} = \frac{e^{-4.18} \times (4.18)^2}{2!}$$

$= 0.133$

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12. $p = 0.05$

$n = 20$

a) Less than 1

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

$= 20c_0 (0.05)^0 (0.95)^{20}$

$= 0.358$

b) Less than and equal to 1.

$\Rightarrow P(x=0) + P(x=1)$

$= 0.358 + 20c_1 (0.05)^1 (0.95)^{19}$

$= 0.735$

c) Max of 2 sites.

$\Rightarrow P(x=0) + P(x=1) + P(x=2)$

$\Rightarrow 0.358 + 0.377 + 20c_2 (0.05)^2 (0.95)^{18}$

$\Rightarrow 0.188 + 0.358 + 0.377 = 0.923$

13. $p = 0.05$

$r = 2$

$n = 5$

a)

$$P(X=2) = 5C_2 (0.05)^2 (0.95)^3$$

$$= 0.0214$$

b) in 2 years.

$$P(X=2) = 2C_2 (0.05)^2 (0.95)^0$$

$$= 0.0025$$

c) $P(X \geq 1) = 1 - P(X<0)$ in 4 years.

$$= 1 - 4C_0 (0.05)^0 (0.95)^4$$

$$= 1 - 0.8145$$

$$= 0.185$$

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14. $p = 0.2$

$n = 15$

a) $X = 2$

$$P(X=2) = {}^{15}C_2 (0.2)^2 \times (0.8)^{13}$$

$$= 0.2308$$

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

$$= 1 - 15C_0 (0.2)^0 \times (0.8)^{15}$$

$$= 0.946$$