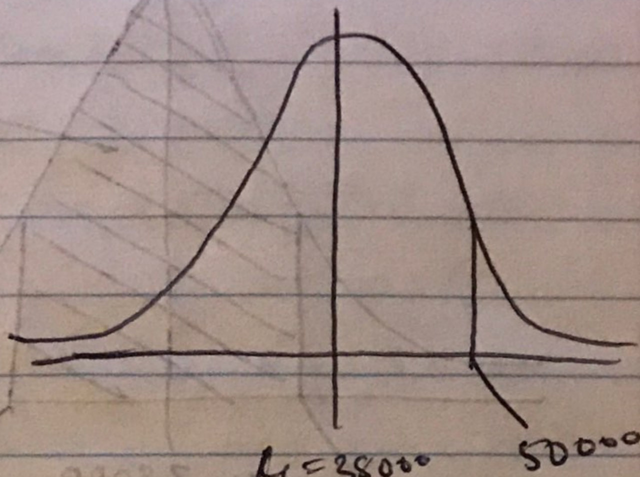
2) $Z = \dfrac{X-\mu}{\sigma}$



$n = 2000$

$\mu = 38000$

$\sigma = 10000$

σ = 10000

n = 2000

$Z = \dfrac{50000 - 38000}{10000}$

$= \dfrac{12000}{10000}$

$Z = 1.2$

area under the curve for $Z = 1.2$ is

0.8849 → left side

$>50,000 = 1 - 0.8849$

$= 0.1151 = 11.51\%$

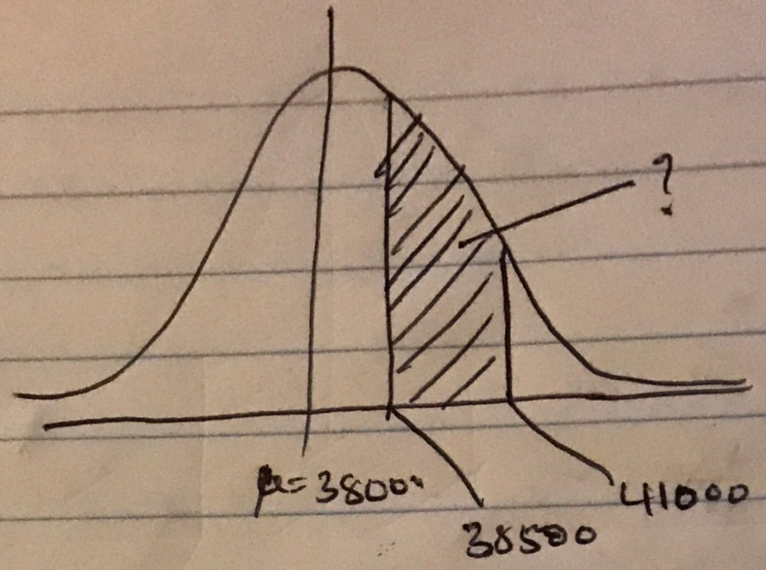
$n = 11.51\%$ of 2000

$= 0.1151 \times 2000$

$= 230.2$

n = 230 firms haves sales over 500000

b)



$$Z_1 = \frac{x-\mu}{\sigma} = \cancel{385} = \frac{38500 - 38000}{10000}$$

$$Z_1 = \frac{5000}{10000} = 0.05$$

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

$$= 0.3$$

area of $Z_1 = 0.05 = 0.5199$

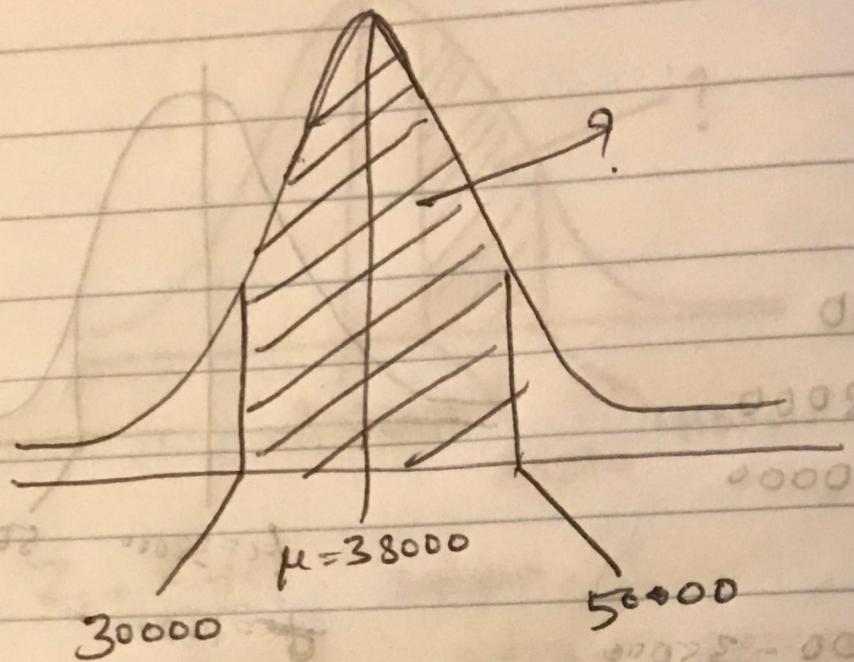
area of $Z_2 = 0.3 = 0.6179$

required area $= 0.6179 - 0.5199$

$= 0.098$

9.8% of ~~8~~ firms have sales between 38500 & 41000.

c)



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

$$= -0.8$$

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

$$= 1.2$$

Z_1 area for -0.8 = 0.2199
Z_2 area for 1.2 = 0.8849

required area = 0.8849 − 0.2199
= ~~0.675~~ 0.673

67.3% ~~66.25%~~ of firms have sales between 30000 & 50000

0.673×2000

= 1346 firms

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4) poisson Distribution:-

$\lambda = 4$

$r = 0$

$$p(x=r) = p(x=0) = \frac{e^{-\lambda}\lambda^{r}}{r!}$$

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

$$= e^{-4} = 0.0183$$

prob that no photon reaches = 1.83%

5) $\lambda = 3$

a) $r = 0$

$$p(x=r) = p(x=0) = \frac{e^{-\lambda}\lambda^{r}}{r!} = \frac{e^{-3}3^{0}}{0!}$$

$$= e^{-3} = 0.0497 = 4.97\%$$

b) $$p(x \geq 2) = e^{-\lambda}\sum_{i=0}^{r} \lambda^{i}/i!$$

3

$$p(x \geq 2) = p(x=2) + p(x=3) + p(x=4) \text{ - - -}$$

$$= 1 - [p(x=0) + p(x=1) + p(x=2)]$$

$$= 1 - e^{-3}\left[\frac{\lambda^{0}}{0!} + \frac{\lambda^{1}}{1!} + \frac{\lambda^{2}}{2!}\right] = 1 - 0.0497(1+3+4.5)$$

$$= 1 - 0.0497(8.5)$$

prob that atleast 2 calls arrive in 2min $= 0.5775 = 57.75\%$

6) $r = \cancel{4}\,3$

$n = 4$

$p = 0.8$ = Success = not defective

$q = 0.2$ = failure = defective

$$p(x = r) = {}^nc_r\, p^r q^{n-r}$$

$$= {}^4c_3 (0.8)^3 (0.2)^1$$

$$= (0.8)^3 (0.2) \times 4$$

$$= 0.1024 \times 4$$

$$= 0.4096$$

Q)

7) $p = 0.3$ = probability of success

$q = 0.7$ = probability of failure

$n = 5$

r = atmost 2 are accepted i.e., $(X \le 2)$

$$P(X \le 2) = P(X=0) + P(X=1) + P(X=2)$$

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

$$= \left(\frac{5!}{5!\,0!}\, 0.7^5\right) + \left(5 \times 0.3 \times 0.7^4\right) + \left(10 \times 0.3^2 \times 0.7^3\right)$$

$$= 0.1681 + 0.3602 + 0.3087$$

$$= 0.837$$

$= 83.7\%$ = probability of atmost 2 are accepted.

which is greater ~~than~~ 800kg $\therefore$ it's not safe.

8) $\mu = 70$ kg
$\sigma = 200$
$X = 800$ kg – given

probability of safety for 10 adults
$\mu = 10 \times 70 = 700$ kgs

$$Z = \frac{X - \mu}{\sigma} = \frac{800 - 700}{200} = \frac{1}{2} = 0.5$$

$= 0.6915$

probability of safety for 10 adults is 69.15%.

for 12 adults $= \mu = 12 \times 70 = 840$ kg

$$Z = \frac{800 - 840}{200} = \frac{-4\cancel{0}}{20\cancel{0}} = \frac{-1}{5}$$

$= -0.2$

$= 0.4207$

probability of safety for 12 adults

$= 42.07\%$

$^nC_r\, p^r q^{n-r}$ — Binomial Dist.

9) $n = 50$

r = atleast 20 to be answered correctly

$p(x \geq 20)$

$p = 1/2$ = probability of success (2 choices)

$q = 1/2$ = probability of failure

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

$= 1 - [p(x=0) + p(x=1) + p(x=2) + p(x=3) + --- p(x=19)]$

$= 1 - [p(x=0) + p(x=1) + p(x=2) + --- + p(x=19)]$

$= 1 - [({}^{50}C_0\, 0.5^0\, 0.5^{50}) + ({}^{50}C_1\, 0.5^1\, 0.5^{49}) + ----$

$+ {}^{50}C_{19}\, 0.5^{19}\, 0.5^{31})]$

4 choices

$p = 1/4$ = probability of success $= 0.25$

$q = 3/4$ = probability of failure $= 0.75$

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

$= 1 - [{}^{50}C_0\, 0.25^0\, 0.75^{50} + {}^{50}C_1\, 0.25^1\, 0.75^{49} + {}^{50}C_2\, 0.25^2\, 0.75^{48}$

$+ ---- + {}^{50}C_{19}\, 0.25^{19}\, 0.75^{31}]$

10) $p = 0.3 =$ probability of success - faulty

$q = 0.7$ - probability of failure - good

$n = 6$

$r = 2$ faulty

$$P(X=2) = {}^{n}C_{r}\, p^{r} q^{n-r}$$

$$= {}^{6}C_{2} (0.3)^{2} (0.7)^{4}$$

$$= 15 \times 0.3^{2} \times 0.7^{4}$$

$$= 0.3241$$

probability that exactly 2 are faulty

$= 32.41\%$

11) 6 errors per hour

6 errors per 60 minutes

for 1 minute $= \frac{6}{60} = 0.1$ error $= \lambda$

for 2 error in 322 word report
given 77 words per minute
then 322 words in 4.18 minutes

for 4.18 min so $\lambda = (0.1)(4.18)$

$$\lambda = 0.418$$

$$r = 2$$

$$p(x=2) = \frac{e^{-\lambda}\lambda^{r}}{r!} = \frac{e^{-0.418}(0.418)^2}{2!}$$

$$= \frac{(0.6584) * 0.1747}{2}$$

$$= 0.0575$$

probability of 2 errors in 322 word report $= 5.75\%$

(2) $p = 0.05\%$ = probability of success = contain soil residuals of dioxin

$n = 20$

$r =$ less than 1

$p(X<1)$

$q = 0.95\%$ = probability of failure = doesn't contain soil residues of dioxin

$$p(x=r) = p(X<1) = p(X=0) = {}^{n}C_{r}\, p^{r} q^{n-r}$$

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

$$= (0.95)^{20} = 0.3585$$

probability that less than 1 site exceeds recommended level of dioxin $= 35.85\%$.

b) $p(x \le 1) = p(x=0) + p(x=1)$

$$p(x=0) = 0.3585$$

$$p(x=1) = {}^{20}C_1 (0.05)^1 (0.95)^{19}$$

$$= 20 \times 0.05 \times 0.3774 = 0.3774$$

$$p(x \le 1) = 0.3585 + 0.3774 = 0.7359 = 73.59\%$$

c) atmost 2 sites

$p(X \le 2) = p(X=0) + p(X=1) + p(X=2)$

$p(X=0) = 0.3585$

$p(X=1) = 0.3774$

$p(X=2) = {}^{20}C_2 \; 0.05^2 \times 0.95^{18}$

$= 190 \times 0.0025 \times 0.3972$

$= 0.1887$

$p(X \le 2) = 0.3585 + 0.3774 + 0.1887$

$= 0.9247$

$= 92.47\%$

13) $p = 0.05\% =$ probability of success = revenue Audits
$q = 0.95\% =$ probability of failure = Non revenue audit companies

$n = 5$

$x = 2$

$p(X=r) = p(X=2) = {}^5c_2 (0.05)^2 (0.95)^3$

$= 10 \times 0.0025 \times 0.8574$

$= 0.0214$

prob that 'RWD' will be selected exactly twice in next 5yrs $= 2.14\%$

b) exactly twice in next 2 years

$n = 2$

$r = 2$

$p(x=2) = {}^2c_2 (0.05)^2 (0.95)^0$

$= 0.05 \times 0.05$

$= 0.0025$

$= 0.25\%$

c) atleast once in next 4 years $p(X \geq 1)$; $n=4$

$p(X=1) + p(X=2) + p(X=3) + p(X=4) = 1 - p(X=0)$

$\boxed{1-p(X=0)} = 1 - {}^4c_0 (0.05)^0 (0.95)^4$

$= 1 - 0.8145 = 0.1855 = 18.55\%$

14) $p = 0.2 = p(\text{success})$ = must stop at any one of traffic signal

$q = 0.8 = p(\text{failure})$ = ~~not~~ ~~failure~~ not stopping

$n = 15$

a) must stop at exactly 2 signals

$r = 2$

$p(x=r) = p(x=2) = {}^{n}c_{r}\, p^{r} q^{n-r}$

$= {}^{15}c_{2} (0.2)^{2} (0.8)^{13}$

$= 105 \times 0.04 \times 0.05498$

$= 0.2309$

$= 23.09\%$ is the probability that a student must stop exactly at 2 signals.

b) $p(x \geq 1)$

$= \cancel{p(x=1) + p(2) +}$

$= p(x=1) + p(x=2) + p(x=3) + \dots p(x=15)$

$= 1 - p(x=0)$

$= 1 - {}^{15}c_{0} (0.2)^{0} (0.8)^{15}$

$= 1 - (0.8)^{15}$

$= 1 - 0.0352$

$= 0.9648$

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