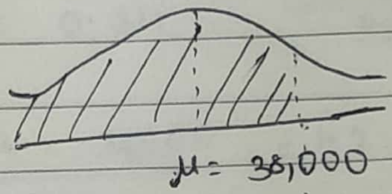
Distribution Assignment.

2. Normally distributed

$\mu = 38,000$

$\sigma = 10,0,00$



a) no of firms with sales > 50,000.

$$z = \frac{x-\mu}{\sigma} = \frac{50,000 - 38,000}{10,000} = 1.2$$

Prob $(x \le 50,000) = 0.8849$

prob $(x > 50,000) = 1 - 0.8849 = 0.1151$

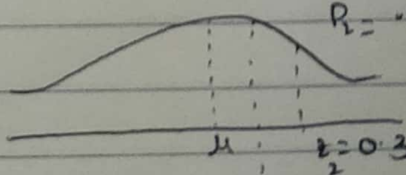
% of montly sales which are > 50,000 is 0.1151

number of firms with sales > 50,000 = 0.1151×2000

$\approx 230.2 \approx 230.$

b) Percentage of sales between 38,500 & 41,000

$$z_1 = \frac{38,500 - 38000}{10,000} = \frac{500}{10,000} = .05$$



$$z_2 = \frac{41,000 - 38000}{10,000} = \frac{3000}{10000} = 0.3$$

$P(x \le 38,500) = .5199$

$P(x \le 41,000) = .6179$

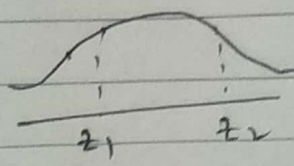
$P(38,500 < x \le 41,000) = .6179 - .5199$

$= .098$

$= 9.8\%$

c) $z_1 = \frac{x_1 - \mu}{\sigma} = \frac{30,000 - 38,000}{10000}$

$= -0.8$



$P_1 = P(x \leq 30,000) = 0.211$

$z_2 = \frac{x_2 - \mu}{\sigma} = \frac{50,000 - 38,000}{10,000} = 1.2$

$P_2 = P(x \leq 50,000) = 0.8849$

$P_2 - P_1 = .8849 - 0.211 = 0.673$

No of firms $= 0.673 \times 2000 \approx \underline{1346}$.

(3) $n = 20$

each question has 4 options

$p = 1/4$ p- Probability of correct

$q = 3/4$ q- " " wrong.

Probability of exactly 5 wrong answers. is

$\underline{{}^{20}C_5 \left(\frac{3}{4}\right)^5 \left(1/4\right)^{15}}$

(4) avg rate of photons reaching the telescope

is $\lambda = 4$ photons / sec

$P(X=0) = \frac{e^{-\lambda} * \lambda^0}{0!} = \underline{e^{-4}} \approx 0.018315$

(5) no of calls per minute $= \lambda = 3$

a) $P(X=0) = \frac{e^{-\lambda}\lambda^{r}}{r!} = \frac{e^{-3}\lambda^{0}}{0!} = e^{-3} = \underline{\underline{0.049}}$

b) Probability of atleast 2 calls.

$P(X \geq 2) = P(X=2) + P(X=3) + P(X=4) + \dots$

$= e^{-3}\left(\frac{3^2}{2!} + \frac{3^3}{3!} + \frac{3^4}{4!} + \dots\right)$

(6) defect rate $= 20\% = .2 = p$

$P(X=4) = q^{(4-1)} p^{1}$

$= \underline{\underline{(0.8)^3 (0.2)}}$

$E(X) = 1/p = 1/0.2 = \underline{\underline{5}}$

5 inspections are needed on avg to get first defective piece.

(7) Probability of student acceptance $= p = 0.3$

rejection $= q = 0.7$

atmost 2 students are accepted

$P_0 + P_1 + P_2 = {}^5C_0 (0.3)^0 (0.7)^5 + {}^5C_1 (0.3)^1 (0.7)^4$
$+ {}^5C_2 (0.3)^2 (0.7)^3$

(8)

$\mu = 70 kg$

$\sigma^2 = 200 \Rightarrow \sigma = \sqrt{200}$

a) for 10 adults

$z = \frac{x - \mu}{\sigma} = \frac{800 - 700}{\sqrt{200}}$

$= \frac{100}{\sqrt{200}} = \frac{10}{\sqrt{2}} \approx ~~0.99~~ \; 7.07$

Prob for $z = 7.07 \approx 0.99$

It reaches ground with 99%. confidence.

b) for 12 adults

$z = \frac{800 - 840}{\sqrt{200}} = \frac{-40}{\sqrt{200}} = -1.414$

Prob for $z = -1.414 \approx 0.07$

It reaches ground with 7% confidence.

(9)

$n = 50$

$P = 1/2 \; , \; q = 1/2$

a) Atleast 20 to be answered correctly to pass

$^{50}C_{20} (1/2)^{20} (1/2)^{30} + {}^{50}C_{21} (1/2)^{21} (1/2)^{29}$

$+ {}^{50}C_{22} (1/2)^{22} (1/2)^{28} + \ldots \; {}^{50}C_{50} (1/2)^{50} (1/2)^{0}$

Atleast 20 $= P_{20} + P_{21} + P_{22} + \ldots P_{50}$

b) $P = 1/4$, $q = 3/4$

$$^{50}C_{20} (1/4)^{20} (3/4)^{30} + {}^{50}C_{21} (1/4)^{21} (3/4)^{29} + \dots$$

$$+ \dots + {}^{50}C_{50} (1/4)^{50} (3/4)^{0}$$

(10) faulty rate = 30% ≈ 0.3

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

(11) efficiency of typing = 6 errors / hr = 0.1 errors/min

= 77 words / min.

1 — 77

(?) — 322

$\frac{322}{77} \approx 4.18$ min.

avg error = 0.1×4.18

= .418

$$P(X=2) = \frac{e^{-\mu} \mu^{r}}{r!} = \frac{e^{-0.418} (.418)^{2}}{2!}$$

= 0.057

$\underline{\underline{\approx 5\%}}$

(12) $P = 5\% = 0.05$

$n = 20$

a) $P(X<1) = P(X=0) = {}^{20}C_0 (0.05)^0 (0.95)^{20}$

$= 0.3585 \approx 35.8\%$

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

$= 35.85 + {}^{20}C_1 (0.05)^1 (0.95)^{19}$

$= 35.85 + 37.73$

$\approx 73.5\%$

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

$= 73.5 + {}^{20}C_2 (0.05)^2 (0.95)^{18}$

$= 73.5 + 18.87$

$\approx 92.36\%$

(13) $P = 5\% = 0.05$

$n = 5$

a) ${}^{5}C_2 (0.05)^2 (0.95)^3 \approx 0.021$

$\approx 2\%$

b) ${}^{2}C_2 (0.05)^2 (0.95)^0 \approx 0.0025$

$= .25\%$

Scanned with CamScanner

c) Atleast 1 in 4 years

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

$= 1 - {}^{4}C_{0}\,(0.05)^{0}(0.95)^{4}$

$= 1 - 0.8145 \approx 0.185 \approx \underline{18.5\ \%}$

(14) $n = 15$

$p = 0.2$

a) ${}^{15}C_{2}\,(0.2)^{2}(0.8)^{13}$

b) 1 or more

$1 - P(X=0) = 1 - {}^{15}C_{0}\,(0.2)^{0}(0.8)^{15}$

$\simeq 1 - 0.035 = \underline{96.48\ \%}$