

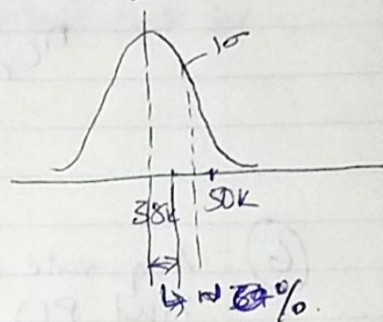
# Distribution Assignment

① Distribution of Ages in Titanic dataset

- plotlib using Matplotlib

② Avg monthly sales of 2000 firms are ND with  $\mu = 38000$  &  $\sigma = 10,000$ .

(a) # of firms with sales over 50k  
 → looking at the plot ~~0.13%~~  $\sim 13\%$



$$Z \Rightarrow \frac{50000 - 38000}{10000} = \frac{12}{10} = 1.2 \Rightarrow 0.8849$$

Right of (50k)  $1 - 0.8849 = 0.1151 = 11.5\%$

# of firms  $\Rightarrow 11.5 \times 2000 = \underline{230 \text{ firms}}$

(b) % of sales b/n 38500 & 41000

$$Z = \frac{38500 - 38000}{10000} = \frac{5}{100} = \frac{1}{20} = 0.05 \Rightarrow 0.5199 = \boxed{0.52}$$

$$\boxed{1 - 0.52 = 48}$$

$$Z = \frac{41000 - 38000}{10000} = \frac{3}{10} = 0.3 \Rightarrow 0.6179 \Rightarrow \boxed{1 - 0.62} = \boxed{0.38 = 38}$$

% of firms  $P(38500 < X < 41000) \Rightarrow 0.6179 - 0.5199 = 0.098$

So, % of firms with sales b/n 38500 & 41000  $\Rightarrow 0.098 = 9\%$

(c) # of firms sales between 30000 & 50000

$$Z = \frac{(50000 - 38000)}{10000} = \frac{12}{10} = 1.2 \Rightarrow 0.8849$$

$$Z = \frac{(30000 - 38000)}{10000} = \frac{-8}{10} = -0.8 \Rightarrow 0.2199$$

b/n 30k-50k  $\Rightarrow 0.8849 - 0.2199 = 0.67 \Rightarrow 67\%$

# of companies  $\Rightarrow 0.67 \times 2000 = \underline{1340}$



Q3 & Q4  $\Rightarrow$  Not required and are out of scope.

- (5) Test with 25 MCQ. with 4 options. probability of answering exactly 5 wrong.

# of questions = 25 =  $n$  exactly 5  $\rightarrow r$

# of options  $\Rightarrow 4 \Rightarrow P(\text{correct}) = 1/4 \Rightarrow p$

$P(\text{incorrect}) = 3/4 \Rightarrow q$

prob of exactly 5 answers

$${}^nC_r p^r q^{n-r} \Rightarrow {}^{25}C_5 \left(\frac{1}{4}\right)^5 \left(\frac{3}{4}\right)^{25-5}$$

$$\Rightarrow {}^{25}C_5 \left(\frac{1}{4}\right)^5 \left(\frac{3}{4}\right)^{25-5}$$

- (6) Avg rate of photons per second = 4.  $\mu = 4$ .  
Find  $P()$  that no photon reaches in given second

$$P(x, m) = e^{-m} \frac{m^x}{x!} \quad \begin{matrix} \hookrightarrow m=4 \\ x=0 \end{matrix}$$

$$P(0, 4) \Rightarrow e^{-4} \times \frac{4^0}{0!} = e^{-4} \Rightarrow 0.0183$$

- (7) # of calls per min into CS center is  $P(m) = 3$ .

(a) no calls in given 1 min period time

$$P(0, 3) = e^{-3} \times \frac{3^0}{0!} = e^{-3} = 0.0498$$

- (b) Assume # of calls are independent for 2 diff min. Find  $P()$  that at least 2 calls will arrive in a given 2 min period (mean = 6)

$$P(x \geq 2) \Rightarrow 1 - P(x=1) = 1 - P(1, 6) \Rightarrow 1 - \left\{ e^{-6} \times \frac{6^1}{1!} \right\} = 1 - (e^{-6} \times 6)$$

$$\Rightarrow 1 - 0.0148 \Rightarrow 0.9851$$



after 3 good ones

(2)

Using PDF:  $P(X=4) \Rightarrow P(1^{st} \text{ non def}) P(4^{th} \text{ def})$   
 $\Rightarrow (0.8)^3 \cdot (0.2)$

(8) prod line has 20% defective rate.

P() obtaining first defective part after 3 good parts.

What is avg of inspections to obtain first defective.

$$q = 0.2 \quad p = 1 - q = 1 - 0.2 = 0.8$$

$$P(X \geq 3) = \cancel{P(X=3)} \overset{x \Rightarrow \# \text{ of trials.}}{(0.8)^{3-1}} \Rightarrow 1 - P(X < 3) = 1 - (1 - (0.8)^2)$$

$$\times \text{ Avg (mean) inspection for } 1^{st} \text{ defect} = \frac{1}{q} = \frac{1}{0.2} = \frac{10}{2} = 5$$

(9) prob that a student is accepted to a prestigious college is 0.3.

If 5 students from same school apply, what is P() that at most 2 are accepted.

$$p = 0.3; \quad q = 1 - p = 0.7; \quad n = 5 \quad r \leq 2$$

$$b(x \leq 2; 5; 0.3) \Rightarrow {}^nC_r p^r q^{n-r}$$

$$\Rightarrow {}^5C_0 (0.3)^0 \times (0.7)^{5-0} + {}^5C_1 (0.3)^1 \cdot (0.7)^{5-1} + {}^5C_2 (0.3)^2 \cdot (0.7)^{5-2}$$

$$\Rightarrow 0.1681 + \frac{5!}{1!(5-1)!} \times 0.3 \times (0.7)^4 + \frac{5!}{2!3!} \times (0.3)^2 \times (0.7)^3$$

$$= 0.1681 + 5 \times 0.3 \times (0.7)^4 + 10 \cdot (0.3)^2 \times (0.7)^3$$

$$= 0.1681 + 0.3601 + 0.3087$$

$$= 0.8369$$

(10)

Max wt. elev can adopt is 800kg. Avg Adult wt = 70kg  $\sigma = 200$

P() that lift safely reaches ground when there are 100 diff adult

wt. of Adult = 70kg

$$\Rightarrow \text{Wt. of 100 Adult} = 70\text{kg} \times 100 = 7000\text{kg}$$

Elevator capacity = 800kg

Elevator will not reach the ground safely.

Well, it will reach the ground, but not the way we expect it to be. 😊

$$\Rightarrow 12 \text{ adults} \Rightarrow 12 \times 70 = 840\text{kg.}$$

Elevator can safely reach the ground.



(11)

MCQ paper with two choices

$$n = 50$$

$$P(\text{success}) = \frac{1}{2} \quad P(\text{fail}) = \frac{1}{2}$$

$$r = 20$$

50 Qs. 20 to be answered correctly.

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

What is  $P()$  that he clears the exam?

20 correct answer to pass  $\Rightarrow r = 20$

$$b(20, 50, 0.5) = {}^{50}C_{20} \times \left(\frac{1}{2}\right)^{20} \times \left(\frac{1}{2}\right)^{50-20}$$

If each question has 4 options:

$$n = 50$$

$$b(20, 50, \frac{1}{4}) = {}^{50}C_{20} \times \left(\frac{1}{4}\right)^{20} \times \left(1 - \frac{1}{4}\right)^{50-20}$$

$$P = \frac{1}{4} \quad q = \frac{3}{4}$$

(12)

LED with faulty rate of 30% if I select 6 bulbs what is  $P()$  that 2 are faulty

$$b(2, 6, 0.3) = {}^6C_2 \times \left(\frac{3}{10}\right)^2 \times \left(\frac{7}{10}\right)^6$$

(13)

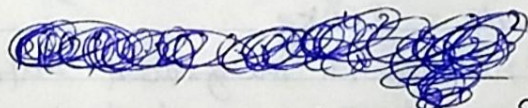
efficiency of typing is 6 errors/hr with 77 words per min  
 $P()$  of 2 errors in 322 word report.

words per min = 77.

$$\text{Time taken for 322 words} = \frac{322}{77} = 4.2 \text{ min.}$$

$$6 \text{ error per hr} \Rightarrow 6 \times \frac{1}{60} \text{ per min} \Rightarrow \frac{1}{10} = 0.1$$

2 errors in 322 word  $\Rightarrow$



$$b(2, 4.2, 0.1) = {}^{4.2}C_2 \times (0.1)^2 \times (0.9)^{4.2}$$