

1) A company mfgs LED bulbs with a faulty rate of 30%. If I randomly select 6 chosen LEDs, what is the probability of having 2 faulty LEDs in my sample? Calculate the avg value of this process. Also evaluate the std dev associated with it.

Soln $n = 6$

prob of 2 wrong LEDs

$$P(x) = \frac{n!}{x!(n-x)!} \cdot p^x \cdot (1-p)^{n-x}$$

$$P(2) = \frac{6!}{2!4!} (0.3)^2 (0.7)^{6-2}$$

$$= 15 \times (0.3)^2 (0.7)^4$$

$$= 0.3241$$

Avg value of the process = $np = 6 \times 0.3 = 1.8$

std dev = $\sigma = \sqrt{np(1-p)} = \sqrt{6 \times 0.3 \times 0.7} = 1.12$

2) Gaurav attempts 8 questions with a correction rate of 75% while Barakha avg around 12 questions / day with correct rate of 45%. What is the probability that each of them will solve 5 questions correctly? What happens in cases of 4 and 6 correct solves? What do you infer from it?

	Gaurav	Barakha
<u>Soln</u> $n =$	8	12
p	0.75	0.45
$1-p$	0.25	0.55
x	5	5

$$P(x) = \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x}$$

a) probability of each of them solving 5 questions correctly.

$$\text{Gammar: } {}^8C_5 (0.75)^5 (0.25)^3 = 0.20 \Rightarrow 20\%$$

$$\text{Barakha: } {}^{12}C_5 (0.45)^5 (0.55)^7 = 0.22 \Rightarrow 22\%$$

b) 4 questions correctly

$$\text{Gammar: } {}^8C_4 (0.75)^4 (0.25)^4 = 9\%$$

$$\text{Barakha: } {}^{12}C_4 (0.45)^4 (0.55)^8 = 17\%$$

c) 6 questions correctly

$$\text{Gammar: } {}^8C_6 (0.75)^6 (0.25)^2 = 31\%$$

$$\text{Barakha: } {}^{12}C_6 (0.45)^6 (0.55)^6 = 21\%$$

Inference: Barakha has ability to answer 12 questions per day. But the correction rate is less. When the correctness of answer increases, then the probability of Gammar increases & Barakha decreases.

3) Customer arrive at a rate of 72/hr to my shop. what is the probability of ~~the~~ customers arriving in 4 min.
a) 5 customers, b) not more than 3 customers, c) more than 3 customers.

Soln $P(x) = \frac{e^{-\mu} \mu^x}{x!}$

$$\mu (1 \text{ hr}) = 72$$

$$\mu (4 \text{ min}) = \frac{72}{60} \times 4 = 4.8 \text{ (4 minutes)}$$

$$P(x=4) = \frac{e^{-4.8} (4.8)^4}{4!} = 0.181$$

$$P(x=5) = \frac{e^{-4.8} (4.8)^5}{5!} = 0.174$$

$$P(x \leq 3) = P(x=0) + P(x=1) + P(x=2) + P(x=3)$$

$$= \frac{e^{-4.8} (4.8)^0}{0!} + \frac{e^{-4.8} (4.8)^1}{1!} + \frac{e^{-4.8} (4.8)^2}{2!} + \frac{e^{-4.8} (4.8)^3}{3!}$$

$$= e^{-4.8} \left[1 + 4.8 + \frac{4.8^2}{2!} + \frac{(4.8)^3}{3!} \right]$$

$$P(x \leq 3) = 0.2931$$

$$P(x > 3) = 1 - P(x \leq 3)$$

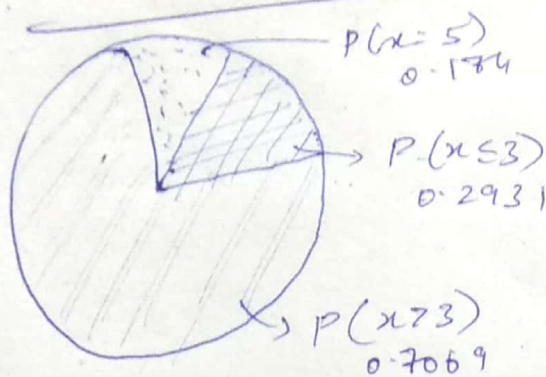
$$= 1 - 0.2931$$

$$= 0.7069$$

$$\therefore P(x \geq 3) = 0.7069$$

$$P(x = 5) = 0.174$$

$$P(x \leq 3) = 0.2931$$



4) Efficiency of entering 77 words/min with 6 errors/hr.
 What is the probability of errors in a 455-word report?
 What happens when no. of words increases/decreases (in case of 1000 words, 255 words)? How is λ affected? How does it influence the PMF?

Soln 77 words/min. $\mu = \frac{6}{60} \times \frac{1}{77} = 0.0013$
 6 errors/hr

$$\mu_{455} = 0.0013 \times 455 = 0.59$$

$$P(x=2) = \frac{e^{-0.59} \times (0.59)^2}{2!} = \frac{0.554 \times 0.3481}{2} = 0.096$$

$$\mu_{1000} = 0.0013 \times 1000 = 1.3$$

$$\mu_{255} = 0.0013 \times 255 = 0.3315$$

$$P(x=2) = \frac{e^{-1.3} \times 1.3^2}{2!} = \frac{0.277 \times 1.69}{2} = 0.229$$

$$P(x=2) = \frac{e^{-0.3315} \times (0.3315)^2}{2!} = \frac{0.729 \times 0.109}{2} = 0.039$$

$\therefore \mu$ increases as words increases and along with that probability also increases.