# DAV-2

## Probability Distribution-4

Poisson Distribution - Revise ✓

Exponential Distribution. ✓

~~Log Normal Distribution.~~

Next week: 3 classes. (2 class by Nabus)

① Tue: Log Normal + CLT Confidence Interval (2.5 hrs)

Thus: Wrap-up (DAV-2) + μ, var of every distribution + PDF, PMF, CDF

② Sat: Problem Solving (mixed)

Ajay ↙

WhatsApp, 240 msgs/hr.

Q1) What is avg time to wait between 2 messages ??

✓ 240 msgs → 3600 sec

✓ 1 msg → ??

$$\frac{3600 \times 1}{240} = 15 \text{ sec.}$$

Q2) What is avg. # messages you receive in 1 sec ??

3600 → 240

1 → ??

$$\frac{1 \times 240}{3600} = \frac{1}{15} = 0.06$$

0.067 msg/second.

$\lambda_1$

Rate ($\lambda$)

Interval - 1 sec

Q3) What is the prob. of having no messages in 10 sec ???

3600 → 240

10 → ??

$$\frac{10 \times 240}{3600}$$

1s → 0.067 msgs

10 sec → $10 \times 0.067 = 10\lambda_1$

Interval → 1 unit

Other Interval → X units, $\lambda = X\lambda_1$

$\frac{1}{s}$

poisson_pmf ( k=0, mu = $10\lambda_1$ )

= 0.5134

Q4) What is the (P) of waiting for more than 10 sec for the next message?

240 msgs in 1 hr (3600 sec)

$\lambda_1 = 1/15$

$\lambda_{10} = 10/15$

✓ $P[T \leq 10]$ → cdf

✓ $P[X = 0,15]$ → pmf of Poisson

Waiting for more than 10 sec to msg

=

Receiving no. msg in 10 sec.

Interval : 10 sec

Rate : $10\lambda_1$

$P[X = 0] = \text{poisson.pmf}(K = 0, mu = 10\lambda_1)$

X : ~~#~~ message in 10 sec

$P[X \leq 2]$ in 10 sec

[0, 1, 2, 3 ... ] (cdf)

$$P[K = 0] = \frac{\lambda^K e^{-\lambda}}{K!}$$

$$= \frac{(10\lambda_1)^0 e^{-10\lambda_1}}{(0)!}$$

$$= e^{-10\lambda_1}$$

$$P[K=0] = e^{-10\lambda_1}$$

Discrete → K: No. of messages received in 10 sec. [0, 1, 2, 3, ...] → Poisson

T: "Time to wait" for the next message → continuous. → Exponential Distribution.

$$P[T>10] = e^{-10\lambda_1}$$

Q What is the prob. of waiting for less than 10 sec to next message?

$$P[T \leq 10] = 1 - e^{-10\lambda_1}$$

CDF → Exponential Distribution.

$$P[T \leq x] = 1 - e^{-x\lambda}$$

```
from scipy.stats import expon.
expon.cdf(x=10, scale=1/λ1)
```

# Data Engineer/SDE - Bugs

Avg. it takes ~5 mins to resolve "a" bug

Memoryless

Q What is the prob. that you'll be able to find the bug in $\leq 5$ mins.

$P[T \leq 5]$

$= cdf(5, 5)$

$5 \longrightarrow 1$

$1 \longrightarrow \frac{1 \times 1}{5} = \frac{1}{5}$

# no. of bugs - Poisson.

$\lambda_1 = 1/5$

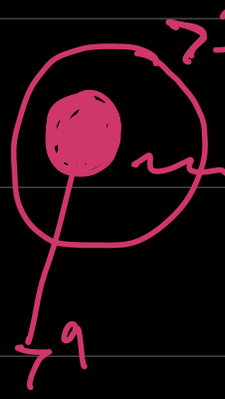
expon.cdf(x=5, scale=5)

Q Prob that solves between 4-5 mins?

$$P[4 \le T \le 5] = cdf(5,5) - cdf(4,5)$$

Q Given that you have already spent 3 mins, prob. of needing more than 9 mins.

$$P[T>9 \mid T>3] = \frac{P(T>9 \cap T>3)}{P(T>3)}$$




$$= \frac{P[T>9]}{P[T>3]}$$

$$= \frac{e^{-9\lambda}}{e^{-3\lambda}}$$

$$= e^{-[9\lambda - 3\lambda]}$$

$$P[T>9 \mid T>3] = e^{-6\lambda}$$

$$P[T>9 \mid T>3] = P[T>6]$$

X

Memoryless