Statistics for Data Science-I

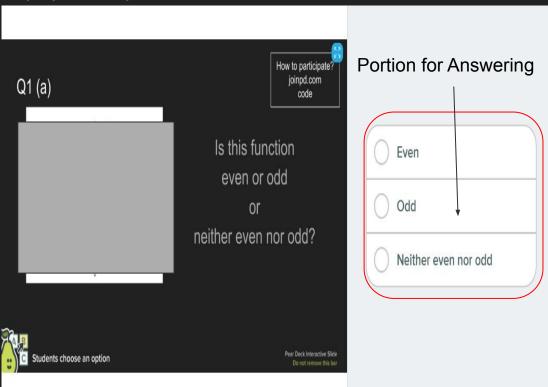
Week 12: Graded Assignment Practice Session

Statistics I: Week 12 Graded Assignment Practice

- Keep a notebook and pen ready for solving problems
- How to join?
 - Audio/screenshare on webex click on link sent to you
 - Doubts? Use webex chat. Do not answer questions on zoom chat.
 - Join on pear deck joinpd.com (enter code seen on top right)
 - Answer questions only here
- For every question 5 to 15 minutes allotted
 - Question will be shown in a slide for solving
 - If you are done solving, enter your answer at joinpd.com
 - Presenter will provide a solution
 - Questions and discussion

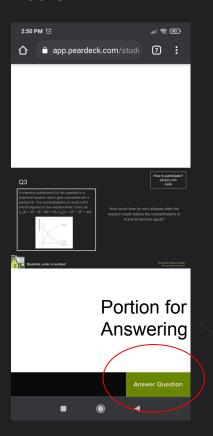
Example Screenshots

Laptop/Desktop



How to participate? joinpd.com code: see above

Mobile



Q1

The lifetime of a light bulb is exponentially distributed with a mean life of 18 months. If there is 60% chance that a light bulb will last at most t months, then what is the value of t?

what is the value of t?



Solution:

Given mean of exponential random variable (life of light bulb)=18 months.

$$\Rightarrow 1/\lambda = 18$$
,

$$\Rightarrow \lambda = 1/18$$
.

Given $P(X \le t) = 0.6$

$$\implies 1 - e^{-\lambda t} = 0.6$$

$$\implies e^{-\lambda t} = 0.4$$

Taking log on both sides and solving

$$\Rightarrow \lambda t = \ln 2.5$$

$$\Rightarrow$$
 1/18 t = ln 2.5 t = 18 ln 2.5

Hence option b is correct.

The probability density function of the time (in minutes) (denoted by X) between calls at the customer care is given by

$$egin{aligned} f(x) &= \left\{ rac{1}{2} e^{rac{-x}{2}} & if \ 0 < x < \infty
ight\} \ &= \left\{ 0 \ otherwise
ight\} \end{aligned}$$

Find the probability that time between calls exceeds the mean time.



$$P(X \ge t) = e^{-\lambda t}$$

$$= e^{-\lambda \times \frac{1}{\lambda}}$$

$$= e^{-1}$$

Q3

The time that Jan shatabdi express will reach the Delhi station is uniformly distributed between 12:00 PM and 2:00 PM.

What is the probability that the train reaches Delhi exactly at 12:30 PM?

How to participate? joinpd.com code: see above

The probability that train reaches exactly at 12:30 PM is

$$\int_{12:30}^{12:30} f(x)dx = 0$$

Since the area under curve at a particular instant of x value is zero.

Q4

The total duration (in minutes) of a badminton match in the Premier Badminton League (PBL) is uniformly distributed between [a, b] with variance 3 square minutes. The probability that a match will last at most 42 minutes is 1/3.

Find the expected time duration (in minutes) of a badminton match

Here, variance = 3

$$egin{aligned} \Rightarrow rac{(b-a)^2}{12} &= 3 \ \Rightarrow (b-a)^2 &= 36 \ \Rightarrow b-a &= +6, -6 \end{aligned}$$

$$P(X \le 42) = 1/3$$
 $P(X \le 42) = \frac{42 - a}{b - a} = 1/3$
 $42 - a = 2$
 $a = 40, b = 46$

$$E(X) = \frac{a+b}{2} = \frac{40+46}{2}$$
= 43

Let a random variable is uniformly distributed over [a, b] with expectation and variance 6 and 4 respectively.

Find the value of ab.



Solution:

$$E(X) = rac{a+b}{2} = 6$$
 $V(X) = rac{(b-a)^2}{12} = 4$ $a+b=12$ $= (b-a)^2 = 48$ $(a+b)^2 = 144$

$$(b+a)^2 - (b-a)^2 = 4ab = 144 - 48 = 96$$

Let X be a uniform random variable with PDF given by

$$f(x) = \{k \quad |x| \leqslant 5\}$$
 $0 \ otherwise$

Find the value of k

$$k = \frac{1}{b-a} = \frac{1}{5-(-5)} = \frac{1}{10}$$