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# Statistics for Data Science-I

Week 12: Graded Assignment Practice Session

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# 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

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## Laptop/Desktop

Q1 (a)

Is this function even or odd or neither even nor odd?

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Portion for Answering

☐ Even

☐ Odd

☐ Neither even nor odd

Students choose an option

Pear Deck Interactive Slide  
Do not remove this bar

## Mobile

2:50 PM

app.peardeck.com/studi

Q3

A chemical substance A is the reactant in a chemical reaction which gets converted into a product B. The concentrations (in mol/L) of A and B depend on the reaction time  $t$  (min) as  $C_A(t) = 20 - 2t^2 - 42t + 90$ ,  $C_B(t) = 20 + 2t^2 + 44t$ .

How much time (in min) elapses after the reaction starts before the concentrations of A and B become equal?

Students, enter a number!

Portion for Answering

☐ Even

☐ Odd

☐ Neither even nor odd

Answer Question

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# 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  $t$ ?



Students, write your response!

## Solution:

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

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

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

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

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

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

Taking log on both sides and solving

## Solution:

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

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

Hence option b is correct.

## Q2

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

$$f(x) = \begin{cases} \frac{1}{2} e^{\frac{-x}{2}} & \text{if } 0 < x < \infty \\ 0 & \text{otherwise} \end{cases}$$

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



Students, enter a number!

Solution:

$$\begin{aligned}P(X \geq t) &= e^{-\lambda t} \\&= e^{-\lambda \times \frac{1}{\lambda}} \\&= e^{-1}\end{aligned}$$

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# Q3

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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?



Students, enter a number!

## Solution:

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



Students, enter a number!

## Solution:

Here, variance = 3

$$\Rightarrow \frac{(b-a)^2}{12} = 3$$

$$\Rightarrow (b-a)^2 = 36$$

$$\Rightarrow b-a = +6, -6$$

## Solution:

$$P(X \leq 42) = 1/3$$

$$P(X \leq 42) = \frac{42 - a}{b - a} = 1/3$$

$$42 - a = 2$$

$$a = 40, b = 46$$

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

# Q5

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

Find the value of  $ab$ .



Students, enter a number!

Solution:

$$E(X) = \frac{a+b}{2} = 6$$

$$a+b=12$$

$$(a+b)^2 = 144$$

$$V(X) = \frac{(b-a)^2}{12} = 4$$

$$= (b-a)^2 = 48$$

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

## Q5

Let  $X$  be a uniform random variable with PDF given by

$$f(x) = \begin{cases} k & |x| \leq 5 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of  $k$



Students, enter a number!



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Solution:

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