


Probability and Random Processes

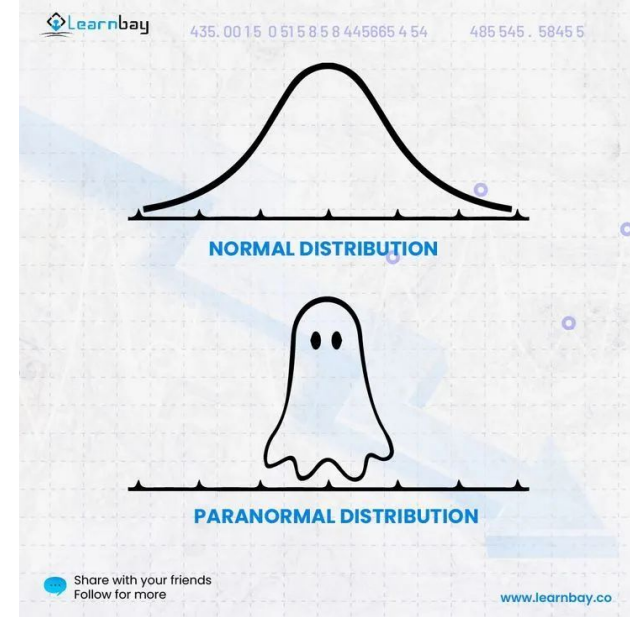
Tutorial-4

20-09-2025



Agenda

- Continuous Random Variables
- Problems - Graph Shading method
- Doubts



Continuous Random Variable

- CDF definition
 - PDF definition
 - What is the probability of the RV taking a particular value?
 - Mean, Variance and LOTUS
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- Understanding the question
 - Formulating a Random Variable
 - Simulations



BELL CURVE



**GAUSSIAN
DISTRIBUTION**

Problem 1

Let X be a random variable with PDF given by

$$f_X(x) = \begin{cases} cx^2 & |x| \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

- Find the constant c .
- Find EX and $\text{Var}(X)$.
- Find $P(X \geq \frac{1}{2})$.

Problem 2

Let X be a continuous random variable with PDF

$$f_X(x) = \begin{cases} x^2 + \frac{2}{3} & 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

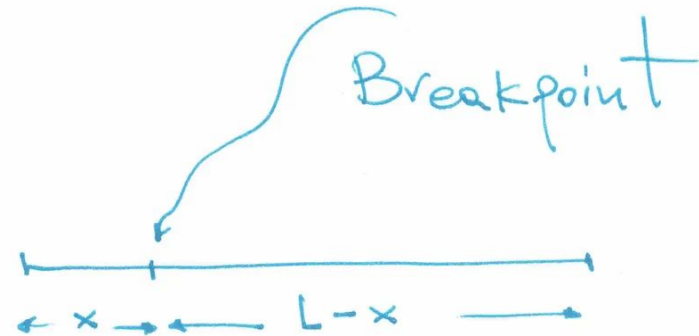
- a. Find $E(X^n)$, for $n = 1, 2, 3, \dots$.
- b. Find the variance of X .

Problem 3

- A clock's minute hand is pointing at a random angle (uniformly on the circle). What is the expected angular distance from the tip of the hand to the 12 o'clock position?

Problem 4

- The stick drops and breaks at a random point distributed uniformly across the length. What is the expected length of the smaller part?



Problem 5

- A research satellite has a circular detector with a radius of R meters. It's designed to measure high-energy cosmic rays. When a cosmic ray strikes the detector, its location is uniformly random over the entire circular area. The scientific value of a strike depends on its distance from the center. Let the random variable D be the distance (in meters) from the center of the detector to the point where a cosmic ray strikes.
 - Find the PDF of D and $E[D]$
 - Find the expected power output. The power is given by $P_{\max}(1-D/R)$ where P_{\max} is a constant.



THANK YOU

Any Doubts?

