LECTURE 11 AND 12

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Contents

11 Important Families of Continuous Probability Distributions

11.1 Exponential Distributions.

Definition 1. Exponential Distributions: Used to model a process in which events occur continuously and independently at a constant average rate. The formula for these distributions is:

$$f(x) = \begin{cases} \lambda e^{-\lambda x} & \text{if } x > 0 \\ 0 & otherwise \end{cases}$$

wherein λ is referred to as the rate.

- $\lambda = \frac{1}{X}$
- $Mean : E[X] = \frac{1}{\lambda}$
- $Variance : \sigma_x^2 = \frac{1}{\lambda^2}$
- $Stdev : \sigma_x = \sqrt{\frac{1}{\lambda^2}} = \frac{1}{X\sqrt{n}}$
- $CDF : P(X < x) = \begin{cases} 1 - e^{-\lambda x} & \text{if } x \geq 0 \end{cases}$
- $CDF : P(X > x) = \begin{cases} e^{-\lambda x} & \text{if } x \geq 0 \end{cases}$

11.2 Gamma Distribution.

Definition 2. Gamma Distribution: The gamma distribution is a continuous distribution, one of whose purposes is to extend the usefulness of the exponential distribution in modeling waiting times. It

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involves a certain integral known as the gamma function. Described by the PDF:

$$f(x) = \begin{cases} \frac{\lambda^r x^{r-1} e^{-\lambda x}}{\Gamma(r} & \text{if } x > 0 \\ 0 & otherwise \end{cases}$$

- $\lambda = \frac{1}{X}$
- $Mean : E[X] = \frac{r}{\lambda}$
- $Variance : \sigma_x^2 = \frac{r}{\lambda^2}$