The exponential distribution

X îs said to have en exponential distribution with parameter 2 (270) if the pdf of X is $f(x; \lambda) = \begin{cases} \lambda e^{-\lambda x} & \text{for } x \neq 0 \end{cases}$ $\begin{cases} 0 & \text{otherwise} \end{cases}$

Note: Exponential distribution is special case of Gamma distribution with condition $\frac{1}{B} = \lambda$ and $\alpha = 1$.

Q: Venify 1) proper pdf 11) E(x) (11) V(x).

 $\int_{-\infty}^{\infty} f(x) dx = \int_{-\infty}^{\infty} \frac{1}{\lambda} e^{\lambda x} dx$ $\int_{-\infty}^{\infty} f(x) dx = \int_{-\infty}^{\infty} \frac{1}{\lambda} e^{\lambda x} dx$ $= \frac{1}{2} \left[\frac{e^{-\lambda x}}{e^{-\lambda x}} \right]_{0}^{\infty} = \frac{1}{2} \left[\frac{e^{-\lambda x}}{e^{-\lambda x}} \right]_{0}^{\infty}$ $= \frac{1}{2} \left[\frac{e^{-\lambda x}}{e^{-\lambda x}} \right]_{0}^{\infty} = \frac{1}{2} \left[\frac{e^{-\lambda x}}{e^{-\lambda x}} \right]_{0}^{\infty}$

 $E(x) = \int_{-\infty}^{\infty} x \cdot f(x) dx \left(1 - x \cdot \int_{-\infty}^{\infty} x \cdot f(x) dx \right) = \int_{-\infty}^{\infty} x \cdot f(x) dx$ $= \int_{0}^{\infty} x \cdot \lambda e^{-\lambda x} dx$

Let $\lambda x = t$ $\Rightarrow \lambda dx = dt$ Genma function $= \frac{1}{2} \int_{0}^{\infty} t \, e^{t} \, dt = \frac{1}{2} \int_{0}^{\infty} t \, e^{t} \, dt$ $= \frac{1}{2} \int_{0}^{\infty} t \, e^{t} \, dt = \frac{1}{2} \int_{0}^{\infty} t \, e^{t} \, dt$ $= \frac{1}{2} \int_{0}^{\infty} t \, e^{t} \, dt = \frac{1}{2} \int_{0}^{\infty} t \, e^{t} \, dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$ $= \frac{1}{\lambda} \int_{0}^{\infty} t^{2-1} e^{-t} dt$

where the parameters &70,870.

The exponential distantation $V(x) = \frac{2}{E(x^2)} - \frac{2}{E(x)}$ The have an exponential distantantary $\frac{2}{E(x)}$ F(x:x) = { x & xx > x } = (x:x) ? $= \frac{1}{\lambda} \int_{-\infty}^{\infty} (\lambda x)^2 e^{-\lambda x} dx$ Note: Exponential distrate, to 22 of the Notes of Gamma distribution with condition prompt to $\frac{2}{\sqrt{1-2}} = \frac{2}{\sqrt{1-2}} = \frac{1}{\sqrt{1-2}}$ $-1.V(x) = \frac{2}{\sqrt{2}} - \frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}}.$ $-1.V(x) = \frac{2}{\sqrt{2}} - \frac{1}{\sqrt{2}}.$ $-1.V(x) = \frac{2}{\sqrt{2}} - \frac{1}{\sqrt{2}}.$ $-1.V(x) = \frac{2}{\sqrt{2}} - \frac{1}{\sqrt{2}}.$ $-1.V(x) = \frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}.$ $-1.V(x) = \frac{1}{\sqrt{2}}.$ $-1.V(x) = \frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}.$ $-1.V(x) = \frac{1}{\sqrt$ Q: Cdf of the exponential distribution.

Solve $F_{\mathbf{x}}(\mathbf{x}) = \int_{0}^{\mathbf{x}} \lambda e^{-\lambda \mathbf{x}} d\mathbf{x}$ = 2 · E-20 (02-1-0) K $E(x) = \int x \cdot f(x) dx \left(e^{-\lambda x} - 1 \right) x = \int x \cdot f(x) dx$ $= 1 - e^{-\lambda x} \cdot 1$ $= \int_{-\infty}^{\infty} x \cdot \lambda = \int_{-\infty}^$ The Gamma Distribution. A continious rzv X is said to brave and gamma distribution if the pdf of X lis $f(x;\alpha,\beta) = \begin{cases} \frac{1}{\beta^{\alpha} \lceil \alpha \rceil} & x^{\alpha+1} e^{-x/\beta}, & \frac{1}{\beta^{\alpha} \lceil \alpha \rceil} \\ 0 & \text{otherwise} \end{cases}$

where the parameters & 70, 370.

If
$$\beta = 19$$
 $f(x; \alpha, 1) = \begin{cases} \frac{1}{\Gamma(\alpha)} x^{\alpha-1} e^{-x} & \text{for } x \neq 0 \\ 0 & \text{otherwise.} \end{cases}$

is called the standard gamma distribution.

$$\int_{0}^{\infty} f(x;\alpha) dx = \frac{1}{\Gamma(\alpha)} \int_{0}^{\infty} x^{\alpha-1} e^{-x} dx$$

$$= \frac{1}{\Gamma(\alpha)} x \Gamma(\infty) = 1, \quad (proper pdf).$$

If
$$x = 1$$
 and $\beta = \frac{1}{\lambda}$,

$$f(x; 1, \frac{1}{\lambda}) = \begin{cases} \frac{1}{(\lambda)^n} & \text{for } x > 0 \\ 0 & \text{otherwise.} \end{cases}$$

$$= \begin{cases} 2 \cdot e^{-\lambda \lambda} & \text{for } x > 0 \\ 0 & \text{otherwise.} \end{cases}$$

$$= \begin{cases} 2 \cdot e^{-\lambda \lambda} & \text{otherwise.} \end{cases}$$

$$= \begin{cases} 2 \cdot e^{-\lambda \lambda} & \text{otherwise.} \end{cases}$$

1)
$$E(x) = \infty \beta$$

11)
$$V(x) = \propto \beta^2$$

111) cdf of gamma distribution.

$$F_{x}(x) = P(x \le x) = \int_{0}^{x} \frac{x^{\alpha-1} e^{-x/\beta}}{\beta^{\alpha} \Gamma(\alpha)} dx$$

$$= \frac{1}{\beta^{\alpha} \Gamma(\alpha)} \int_{0}^{x} x^{\alpha-1} e^{-x/\beta} dx.$$

Let
$$\frac{x}{\beta} = t$$
 $\Rightarrow \frac{dx}{\beta} = dt$

$$= \frac{1}{\beta^{\alpha} \lceil \alpha \rceil} \int_{0}^{\infty} (\beta t)^{\alpha - 1} e^{-t} d(\beta t) = \frac{\Gamma(\alpha)}{\Gamma(\alpha)} = 1.$$