Continuous Distributions

(a) The continuous uniform distribution

(b) The exponential distribution

(c) The Weibull distribution

(d) The Pareto distribution

Other useful Continuous Distributions

Pareto distribution for a single such quantity whose log is exponentially distributed; the prototypical power law distribution

Log-normal distribution for a single such quantity whose log is normally distributed

Weibull distribution

Weibull Distribution

The Weibull distribution is used

- in survival analysis
- in reliability engineering and failure analysis
- in industrial engineering to represent manufacturing and delivery times
- in extreme value theory
- in weather forecasting

The probability density function of a Weibull random variable x is:

$$f(x; \lambda, k) = \begin{cases} \frac{k}{\lambda}\left(\frac{x}{\lambda}\right)^{k-1} e^{-(x/\lambda)^k} & x \geq 0, \\ 0 & x < 0, \end{cases}$$

where $k > 0$ is the shape parameter and $\lambda > 0$ is the scale parameter of the distribution.

Important Characteristics of a Continuous Probability Distribution

- Expected value $E(X)$
- Variance
- probability density function $(f(X))$
- cumulative distribution function $(F(X))$

Exponential Distribution : Expected Value

Expected Value of an exponentially distributed random variable X, specifed with the **rate parameter** λ

$$X \sim exp(\lambda)$$

is computed using the following formula

$$E(X) = \frac{1}{\lambda}$$

Uniform Distribution : Expected Value

Expected Value of a uniformly distributed random variable X, specifed with (with maximum value b and minimum value a , i.e.

$$X \sim U(a, b)$$

is computed using the following formula

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