Survival function

The **survival function**, also known as a survivor function or reliability function, is a property of any random variable that maps a set of events, usually associated with mortality or failure of some system, onto time.

It captures the probability that the system will survive beyond a specified time.

reliability function

- The term **reliability function** is common in engineering while the term survival function is used in a broader range of applications, including human mortality.
- Another name for the survival function is the complementary cumulative distribution function.

Definition

Let T be a continuous random variable with cumulative distribution function $F(t)$ on the interval $[0, \infty)$.
Its survival function or reliability function is:

$$R(t) = P(\{T > t\})$$

$$R(t) = \int_t^{\infty} f(u)\, du, .$$

$$R(t) = 1 - F(t).$$

Properties of the Survival Function

- Every survival function $R(t)$ is monotonically decreasing, i.e. $R(u) \leq R(t)$ for all $u > t$.
- The time, t $= 0$, represents some origin, typically the beginning of a study or the start of operation of some system.
- $R(0)$ is commonly unity but can be less to represent the probability that the system fails immediately upon operation.
- The survivor function is right-continuous.