

Statistics:

Exponential Distribution



Before reading, make sure you are familiar with the concept of expected value and variance (see extra handout available on this).

What is the Exponential Distribution?

The Exponential Distribution is a continuous valued probability distribution that takes positive real values. It has one parameter λ which controls the shape of the distribution.

The probability density function for an Exponential Distribution is

Expected Value

$$E(X) = \int_0^{\infty} x \lambda \exp^{-\lambda x} dx$$

Variance

$$\text{Var}(X) =$$

What can it be used for?

The Exponential Distribution is a simple distribution which can be used to model such things a lifetime of machine components or lightbulbs.

Calculating Probabilities

The lifetime of the light bulb in a room is modelled using an Exponential Distribution with parameter λ

Q: What is the probability that the light bulb will last more than 6 months.

A: To calculate this we need to use the probability mass function of the Poisson Distribution. This is:

$$P(X = x) =$$

For there to be less than 3 accidents, either 0, 1, 2 accidents have to occur.

$$\begin{aligned} P(< 3 \text{ accidents}) &= P(X = 0) + P(X = 1) + P(X = 2) \\ &= \\ &= 0.34 \end{aligned}$$

Important: Check that you are able to use the formula correctly to calculate these values.