

From: <http://stattrek.com/probability-distributions/poisson.aspx>

Poisson Distribution

A Poisson distribution is the probability distribution that results from a Poisson experiment.

Attributes of a Poisson Experiment

A **Poisson experiment** is a [statistical experiment](#) that has the following properties:

- The experiment results in outcomes that can be classified as successes or failures.
- The average number of successes (μ) that occurs in a specified region is known.
- The probability that a success will occur is proportional to the size of the region.
- The probability that a success will occur in an extremely small region is virtually zero.

Note that the specified region could take many forms. For instance, it could be a length, an area, a volume, a period of time, etc.

Notation

The following notation is helpful, when we talk about the Poisson distribution.

- e : A constant equal to approximately 2.71828. (Actually, e is the base of the natural logarithm system.)
- μ : The mean number of successes that occur in a specified region.
- x : The actual number of successes that occur in a specified region.
- $P(x; \mu)$: The **Poisson probability** that exactly x successes occur in a Poisson experiment, when the mean number of successes is μ .
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Poisson Distribution

A **Poisson random variable** is the number of successes that result from a Poisson experiment. The [probability distribution](#) of a Poisson random variable is called a **Poisson distribution**.

Given the mean number of successes (μ) that occur in a specified region, we can compute the Poisson probability based on the following formula:

Poisson Formula. Suppose we conduct a Poisson experiment, in which the average number of successes within a given region is μ . Then, the Poisson probability is:

$$P(x; \mu) = (e^{-\mu}) (\mu^x) / x!$$

where x is the actual number of successes that result from the experiment, and e is approximately equal to 2.71828.

The Poisson distribution has the following properties:

- The mean of the distribution is equal to μ .
- The [variance](#) is also equal to μ .