The Poisson Distribution

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- The number of defective items produced in a day on the assembly line of a farm equipment manufacturer.

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- The number of fatal traffic accidents in a city in a particular week.
- The number of customers arriving at the store checkout line during a given hour.
- The number of defective items produced in a day on the assembly line of a farm equipment manufacturer.

The number of occurrences can be viewed as a random variable which can then be approximated by the Poisson distribution

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The Poisson Distribution

Probability Mass Function

$$P(X = x) = \frac{e^{-\lambda}\lambda^{x}}{x!}$$

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the POISSON.DIST function

Poisson Distribution, the POISSON.DIST function

=POISSON.DIST(x, λ, FALSE/TRUE)

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Example:

A local convenience store uses a Poisson distribution to approximate the number of customers arriving each hour during weeknights at the only checkout counter at the store. From past data it knows that on average 30.5 customers arrive per hour at the checkout counter during weeknights.

Poisson Distribution, the POISSON.DIST function

Example:

A local convenience store uses a Poisson distribution to approximate the number of customers arriving each hour during weeknights at the only checkout counter at the store. From past data it knows that on average 30.5 customers arrive per hour at the checkout counter during weeknights.

Q1: What is the probability that 25 customers arrive at this checkout counter in a given hour during a weeknight?

Poisson Distribution, the POISSON.DIST function

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A local convenience store uses a Poisson distribution to approximate the number of customers arriving each hour during weeknights at the only checkout counter at the store. From past data it knows that on average 30.5 customers arrive per hour at the checkout counter during weeknights.

Q1: What is the probability that 25 customers arrive at this checkout counter in a given hour during a weeknight?

P(Customers = 25) = POISSON.DIST(25, 30.5, FALSE)
= 0.0469

Poisson Distribution, the POISSON.DIST function

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Q2: What is the probability that fewer than 33 customers arrive at this checkout counter in a given hour during a weeknight?

Poisson Distribution, the POISSON.DIST function

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A local convenience store uses a Poisson distribution to approximate the number of customers arriving each hour during weeknights at the only checkout counter at the store. From past data it knows that on average 30.5 customers arrive per hour at the checkout counter during weeknights.

Q2: What is the probability that fewer than 33 customers arrive at this checkout counter in a given hour during a weeknight?

P(Customers < 33) = P(Customers ≤ 32)
= POISSON.DIST(32, 30.5, TRUE)
= 0.6511

Poisson Distribution, the POISSON.DIST function

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Q3: What is the probability that the number of customers who arrive at this checkout counter in a given hour during a weeknight will be greater than 35?

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Q3: What is the probability that the number customers who arrive at this checkout counter in a given hour during a weeknight will be greater than 35?

P(Customers > 35) = 1 - P(Customers ≤ 35)
= 1 - POISSON.DIST(35, 30.5, TRUE)
= 0.1810