

# The Poisson Distribution

**Data Science for Quality Management:  
Probability and Probability Distributions**  
with **Wendy Martin**

## **Learning objectives:**

Describe the Poisson probability distribution

Calculate probabilities using the Poisson distribution

# The Poisson Distribution

- This probability distribution is for discrete random variables which can take integer (whole) values (ordinal data).

# Poisson Data Examples

- The number of parts produced during a 10 minute period
- The number of breakdowns per shift
- The number of failures per 100 cycles

# The Poisson Formula

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

where

$P(X)$  = probability exactly  $X$  occurrences

$\lambda$  = Mean number of occurrences per time interval (or unit)

$e = 2.71828$

# Poisson Example

- $\lambda = 25$  parts produced per hour
- $X = 10$  parts produced in one hour

$$P(10) = \frac{25^{10}}{10!} e^{-25}$$

$$= 0.0000365$$

# The Poisson Distribution in R

In R / Rstudio

```
> table.dist.poisson( $\lambda$ )
```

```
> ppois( )
```

# Test for Poisson Distribution

In R / Rstudio

```
> poisson.dist.test( )
```



# Sources

- Luftig, J. An Introduction to Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1982