Individuals and Moving Range Charts – Distribution Fitting

Data Science for Quality Management: X and Moving Range Charts for Non-Normally Distributed Data

with **Wendy Martin**

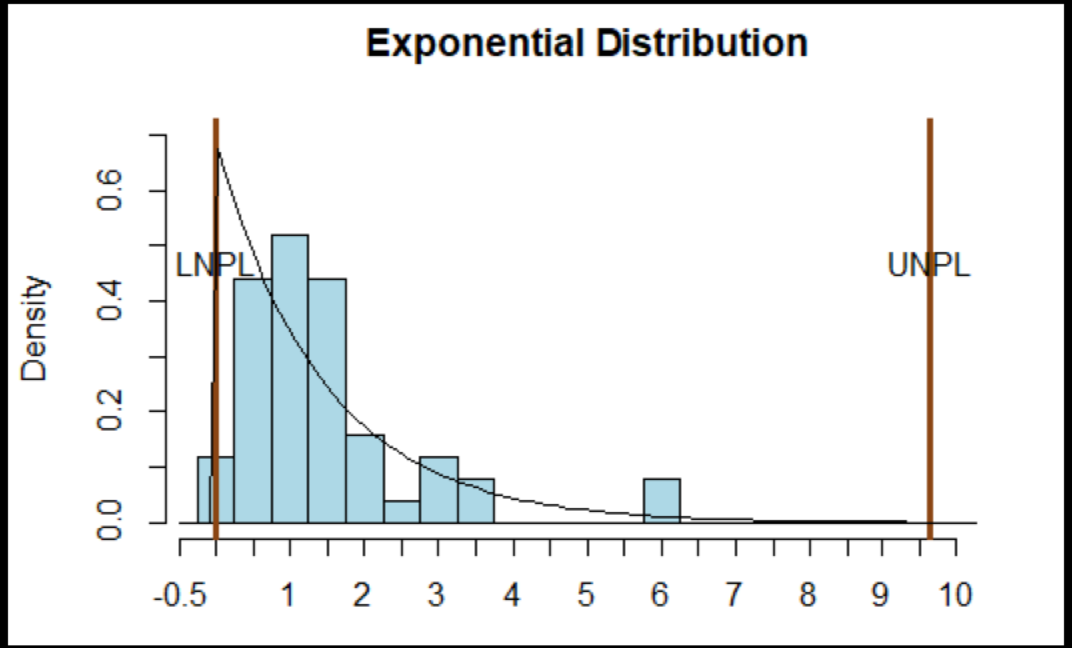
Learning objective:

Calculate Control Limits for data using a fitted distribution

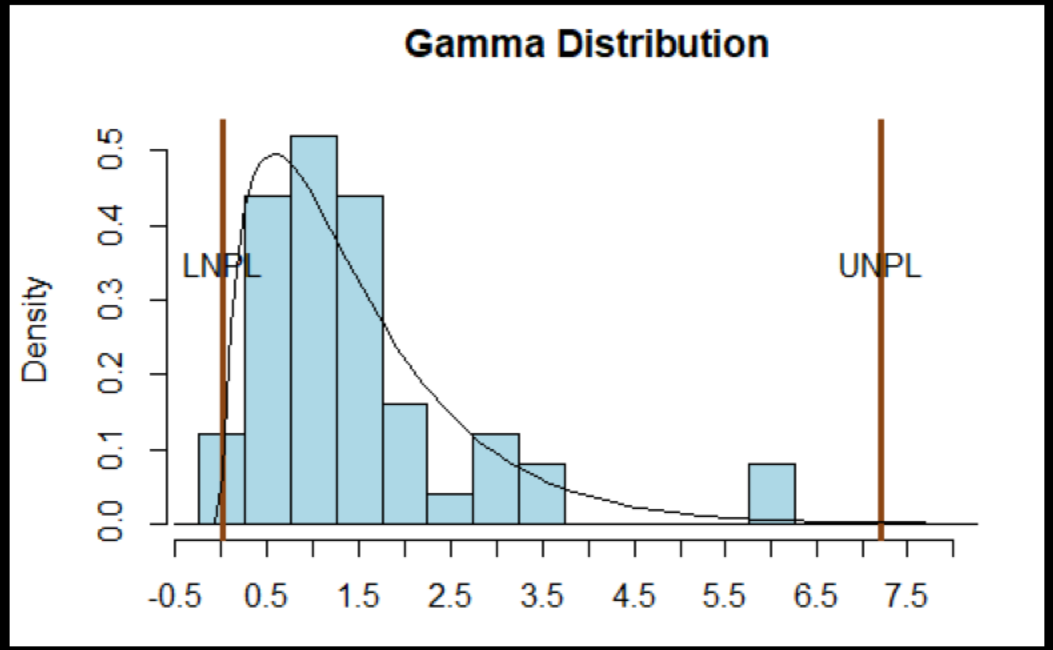
X and MR Charts Non-Normal Distributions

- Let’s look at some possibilities for the Map Sensor data

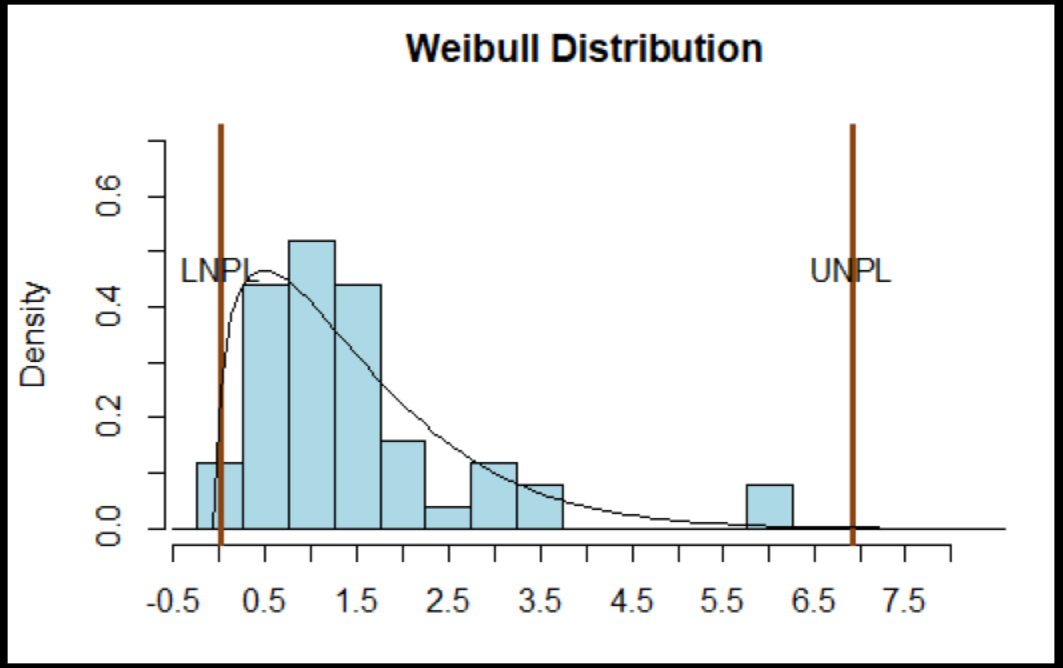
X and MR Charts Non-Normal Distributions



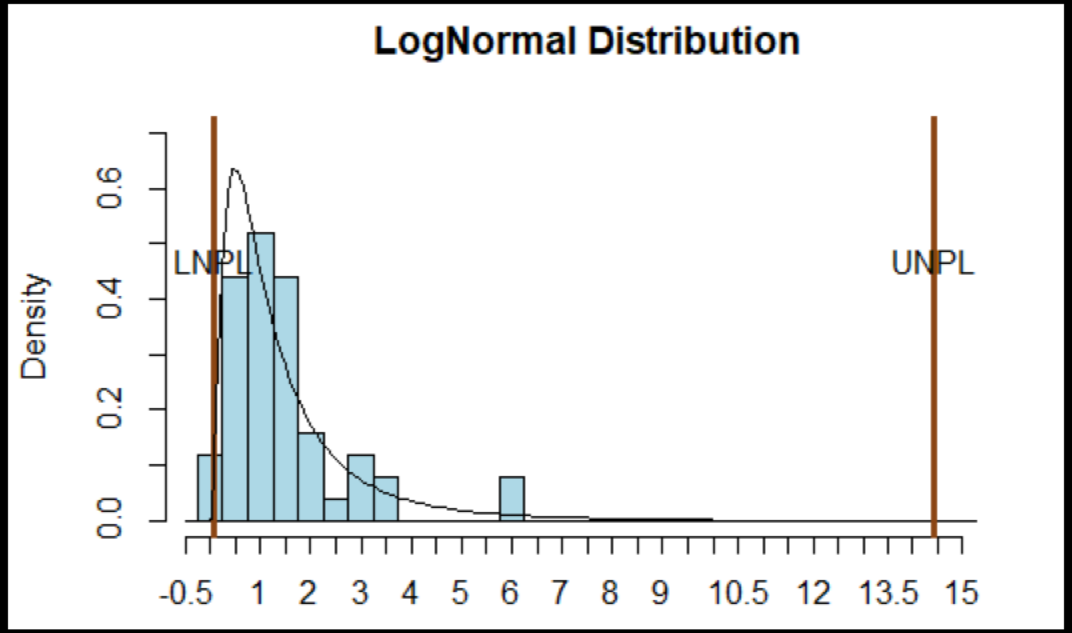
X and MR Charts Non-Normal Distributions



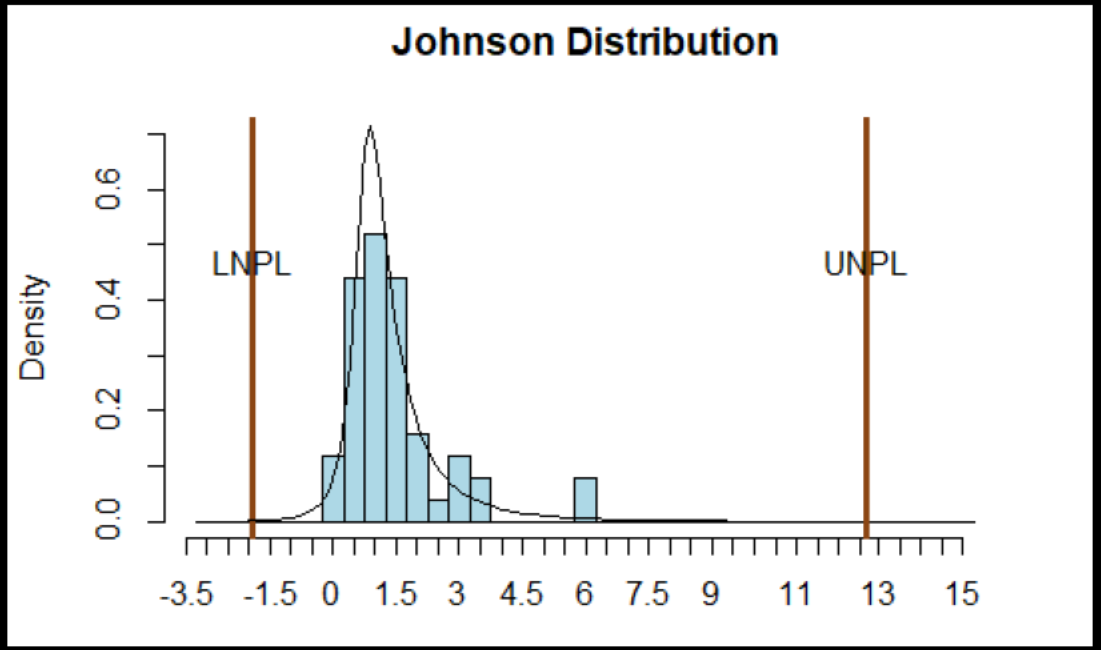
X and MR Charts Non-Normal Distributions



X and MR Charts Non-Normal Distributions



X and MR Charts Non-Normal Distributions



X and MR Charts Non-Normal Distributions

- Best fit from available distributions is the distribution with:
  - Lowest AIC value
  - Best fit in the tail regions in plots

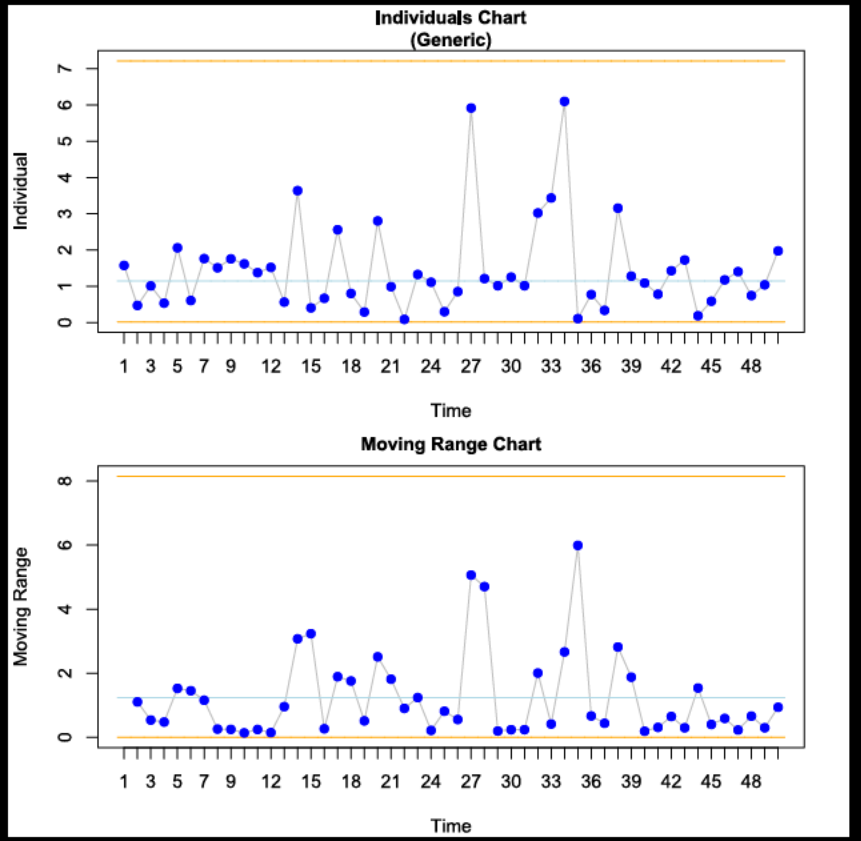
X and MR Charts Non-Normal Distributions

Distribution	LPL	UPL	AIC	Other
Exponential	0.002	9.644	139.81	
Weibull	0.009	6.913	136.89	
Gamma	**0.021**	**7.213**	**135.31**	
Log Normal	0.076	14.418	136.99	
Johnson	-1.908	12.687	147.71	

X and MR Charts & Non-Normal Distributions

Control Chart with Gamma distribution for the individuals, Exponential distribution for moving range

```
spc.chart.variables.individual.and.movingrange.
generic.simple(individuals = mapsensor$z_axis
,chart1.center.line = median(mapsensor$z_axis)
,chart1.control.limits.lcl = LNPL.gamma
,chart1.control.limits.ucl = UNPL.gamma
,chart2.control.limits.lcl = LNPL.mr.exp
,chart2.control.limits.ucl = UNPL.mr.exp)
```



Sources

The material used in the PowerPoint presentations associated with this course was drawn from a number of sources. Specifically, much of the content included was adopted or adapted from the following previously-published material:

- Luftig, J. An Introduction to Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1982
- Luftig, J. Advanced Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1984.
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- Luftig, J. Guidelines for Reporting the Capability of Critical Product Characteristics. Anheuser-Busch Companies, St. Louis, MO. 1994
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- Luftig, J. and Petrovich, M. Quality with Confidence in Manufacturing. SPSS, Inc. Chicago, IL 1997
- Littlejohn, R., Ouellette, S., & Petrovich, M. Black Belt Business Improvement Specialist Training, Luftig & Warren International, 2000
- Ouellette, S. Six Sigma Champion Training, ROI Alliance, LLC & Luftig & Warren, International, Southfield, MI 2005