Individuals and Moving Range Charts – Data Transformation

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

with **Wendy Martin**

Learning objective:

Calculate the natural tolerance of the transformed distribution and transform it back into the original distribution

Transforming Non-Normal Distributions

- Once we've transformed the data, we can calculate the:

- Upper Natural Process Limit at + 3σ
- Lower Natural Process Limit at – 3σ.

Transforming Non-Normal Distributions

In R Studio

```
natural.tolerance.normal(x = Delivery$lntemp)
Delivery.ln<-natural.tolerance.normal(x = Delivery$lntemp)
(LNPL.ln<-Delivery.ln$lower.limit) = 3.586387
(UNPL.ln<-Delivery.ln$upper.limit) = 3.949363
```

Transforming Non-Normal Distributions

Once the UNPL and LNPL have been determined in the transformed distribution, we would then use these values to generate our control limits for our raw data chart by taking the inverse of the log values.

Transforming Non-Normal Distributions

In R Studio

```
(LNPL<-exp(LNPL.ln)) =
```

$e^{3.586387} = 36.1034$

```
(UNPL<-exp(UNPL.ln)) =
```

$e^{3.949363} = 51.9023$

Transforming Non-Normal Distributions

- These new control limits for the X chart would be placed into the upper and lower control limits.
- The centerline would be changed to the median, and the Moving Range chart values would be identical to what was previously employed.

Transforming Non-Normal Distributions

```
spc.chart.variables.individual.and.movingrange.
generic.simple(individuals = Delivery$Temp,
      chart1.center.line = median(Delivery$Temp),
      chart1.control.limits.ucl = UNPL,
      chart1.control.limits.lcl = LNPL)
```

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
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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