np Charts: Control Charts for Proportions / Percentages

Data Science for Quality Management: Control Charts for Discrete Data

with **Wendy Martin**

Learning objectives:

Calculate Control Limits for the np chart using the normal approximation

Calculate Control Limits for the np chart using the exact calculation

Generate the np chart using R software

Control Limits (Normal Approximation)

$$\text{UCL} = \overline{np} + 3\sqrt{\overline{np}(1 - \bar{p})} \quad = 17.69$$

For the Total

$$\text{LCL} = \overline{np} - 3\sqrt{\overline{np}(1 - \bar{p})} \quad = \text{none}$$

For the Total

Exact Binomial Control Limits

- Using the binomial distribution
  - Calculate $\bar{p}$ by dividing the average number of defects (8.8) by the sample of 5000 = 0.00176 for Total

  - Find UCL where P(r and above) $\leq$ 0.00135 and use (r − 0.5) for the UCL **= 19.5**

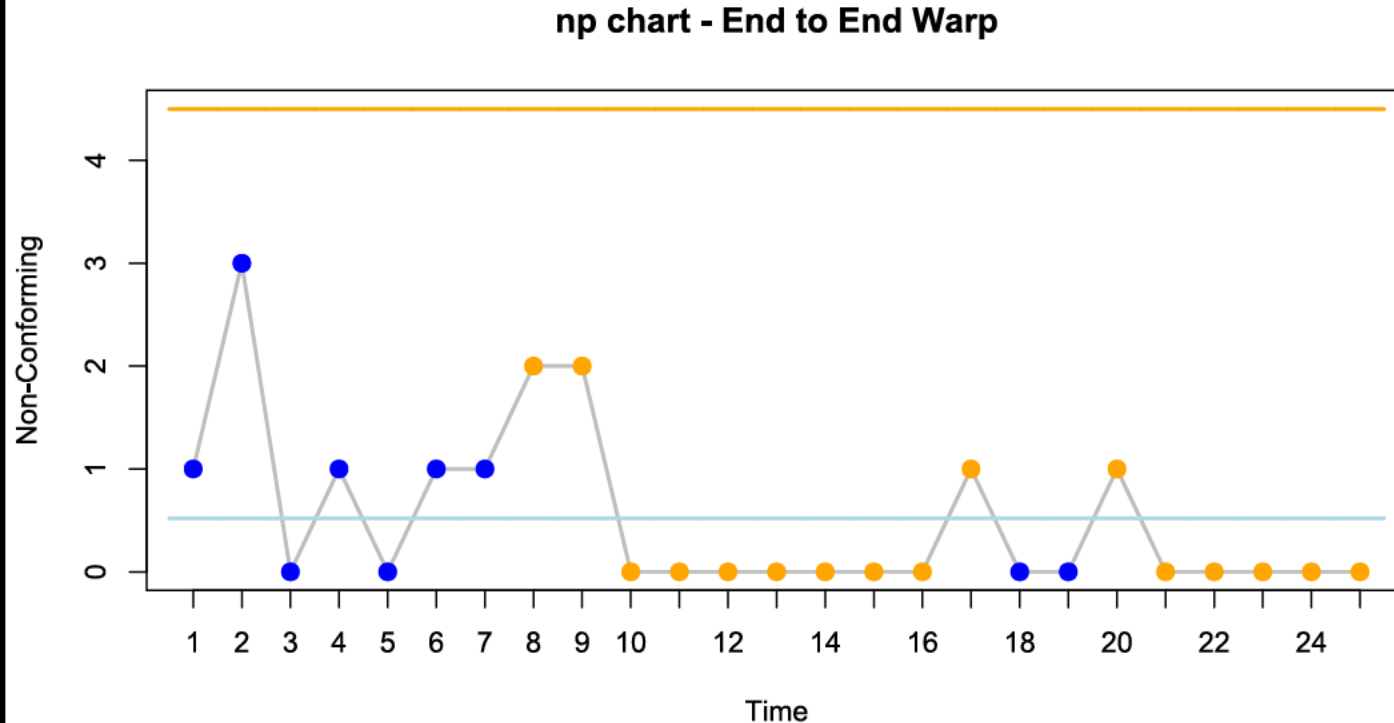 - Find LCL where P(r and below) $\leq$ 0.00135 and use (r + 0.5) for the LCL **= 0.5**
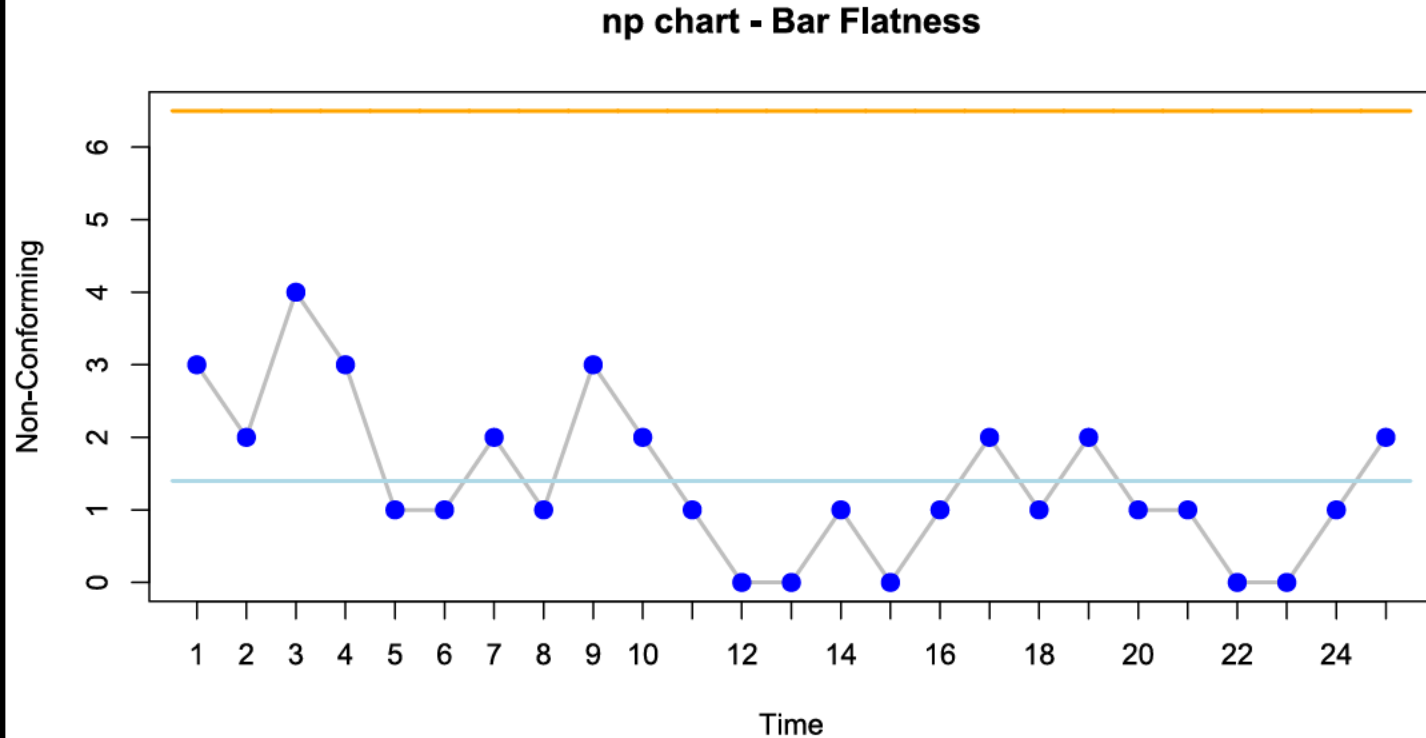
Control Chart Total

np chart - Total Number of Defective Units
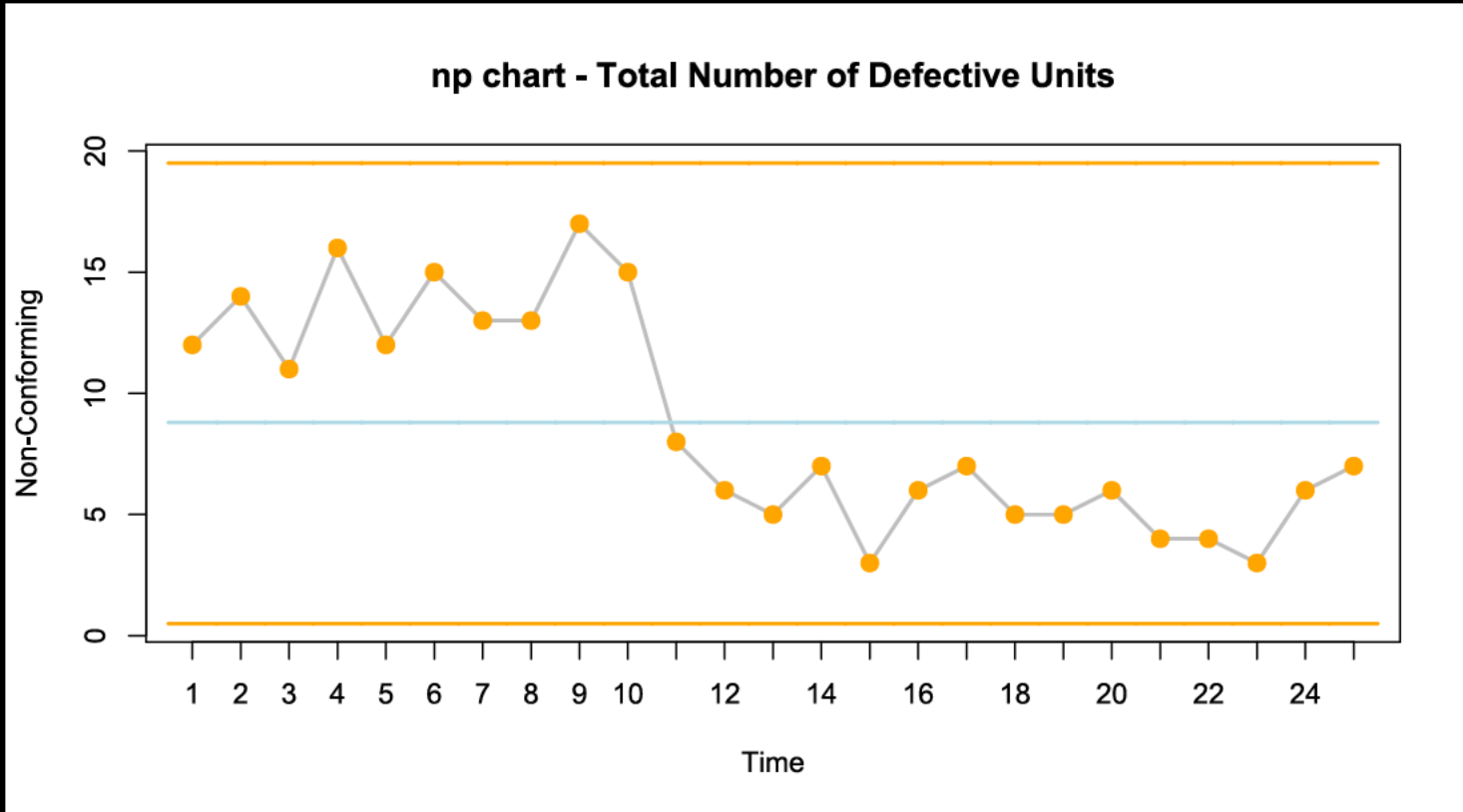
Control Chart Scratches

np chart - Number of Scratches
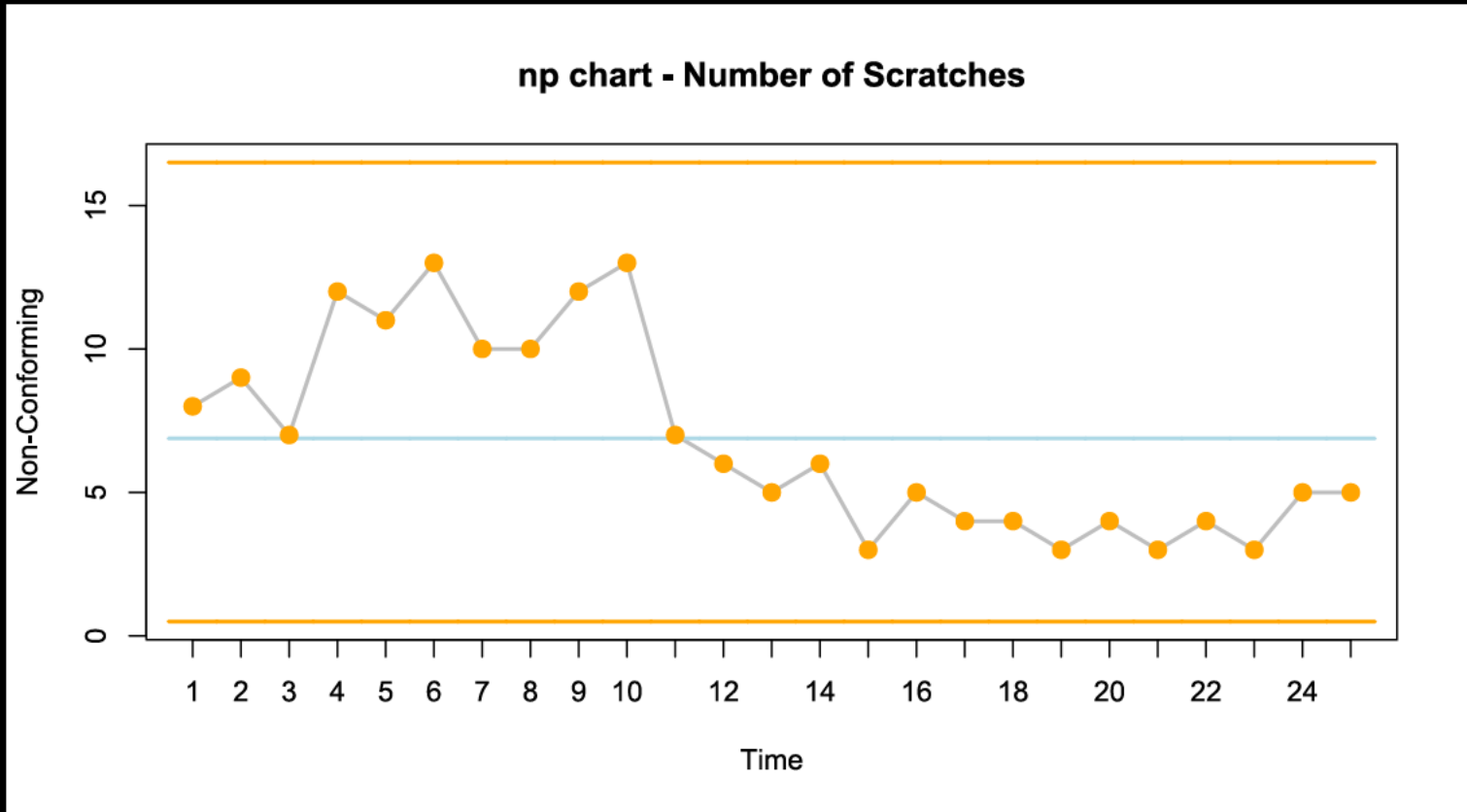
Control Chart Warp

np chart - End to End Warp

Control Chart Flatness

np chart - Bar Flatness

Step 6: Assess the Process for Control

- Assess the process for: points outside the limits, runs, trends, cycles, and unusual patterns of variation.

- Can you provide an explanation as to why it was important not to just look at the 'Total'?

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