c Charts: Control Charts for Count Data

Data Science for Quality Management: Control Charts for Discrete Data

with **Wendy Martin**

Learning objectives:

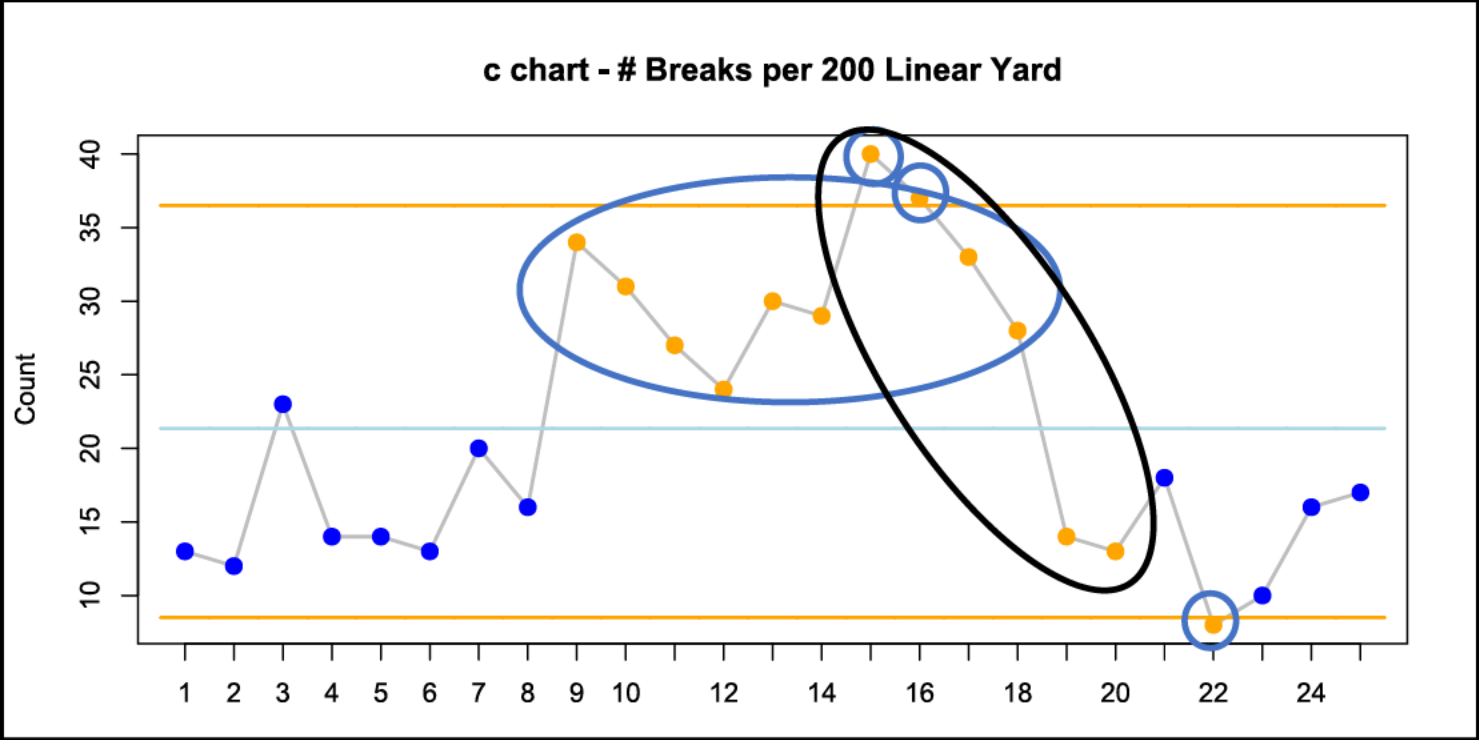
Assess the c chart for process control

Calculate an estimate for process capability

Step 6 - Assess the Process for Control

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

Step 6 — Assess the Process for Control



Step 6 - Assess the Process for Control

- We find two points outside the limits and a run of 10 points above the centerline as well as a trend, excess variation, and a point outside the lower limit

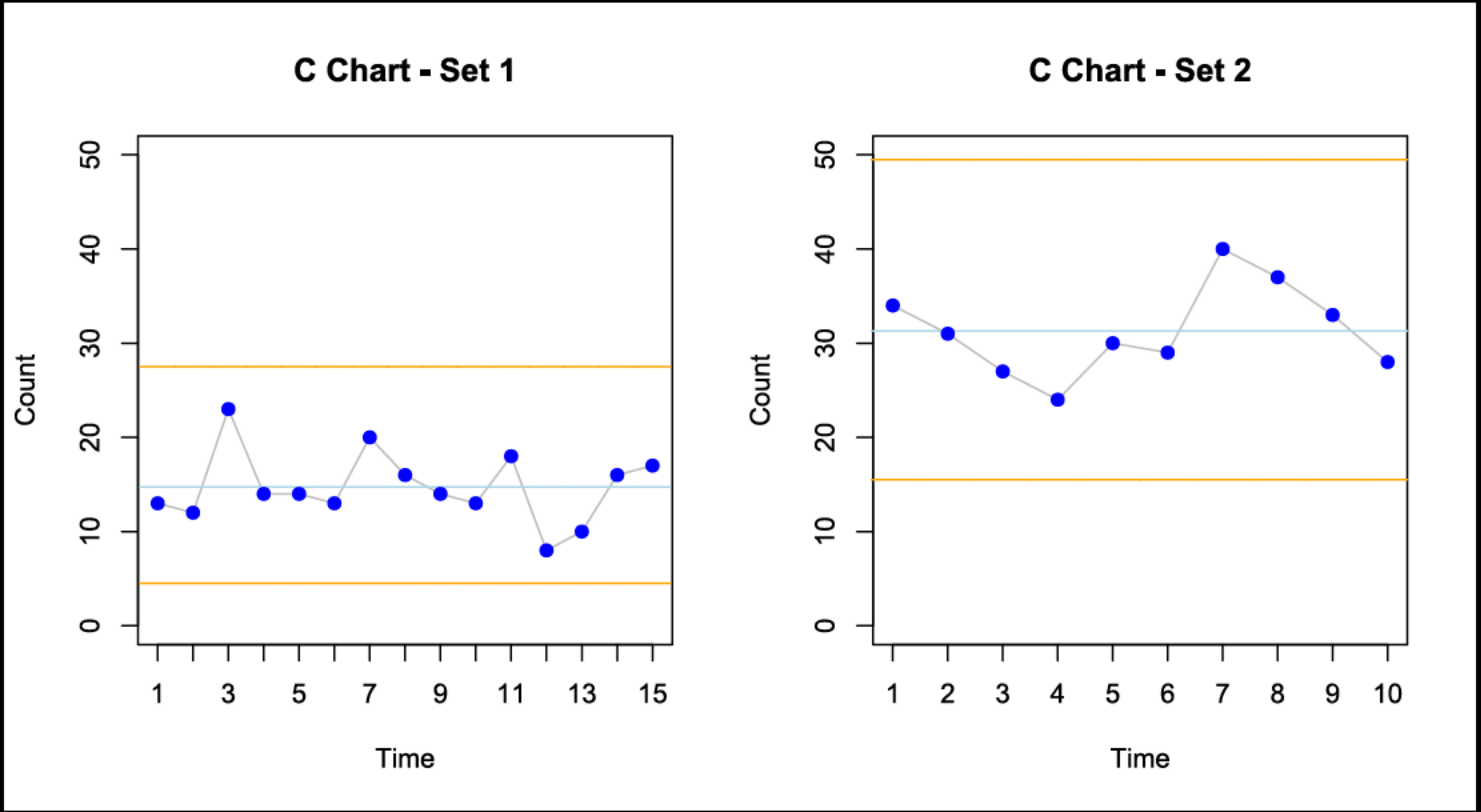
- The process is not displaying control

Step 6 - Assess the Process for Control

- The supplier's process was changing in its rate of nonconformities

- For fun, let us add in two sets to show the changes. This may help the supplier to figure out what happened.

Control Chart Showing Shift



Step 7 — Assess Process Capability

- In the case of nonconformities, capability is usually defined by some industry standard or internal expectation in accord with defined expectations, compared to $\bar{c}$.

- In this case, the process is not stable, and no assessment of capability would be appropriate

Step 7 — Assess Process Capability

- If the process was in a state of statistical control, we would calculate Cpk_eq as follows:

- The industry standard for this insulated wire is an average of 27.5 defects per 200 linear yards

Step 7 — Assess Process Capability

- Using the Poisson table, we would find the probability of getting 28 or more per 200 linear yards

- Then, use that probability to calculate an equivalent Zscore, then divide by 3 to get Cpk_eq.

Conclusions

- Unfortunately, this supplier, who has promised higher quality, is not yet in a position to make any guarantees
- The supplier's process is not yet stable
- The supplier must identify the source of the special cause that created the run half-way through our sampling period

Conclusions

- To the supplier's credit, statistical techniques were used to qualify the process prior to the initiation of production. This demonstrates the supplier's strong commitment to process improvement.
- The ability to improve a process before it has been turned over to production is much greater than after production commitments have been made.

Conclusions

- Continued work with this supplier may result in the ability to achieve both higher quality and lower costs.

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