# Control Chart Basics

**Data Science for Quality Management: Process Control and Control Charts**

with **Wendy Martin**

**Learning objectives:**

Discern between when to react, and when to leave the process alone

Describe the anatomy of a control chart

# Control Charts

- Control charts are tools that allow the detection of through-time changes in a process.

# Control Charts

- By understanding when process changes occur, the **source** of these changes may be detected, and countermeasures can be implemented against unwanted changes

# Control Charts

- Control charts are not necessarily control methods; they are tools for process study.

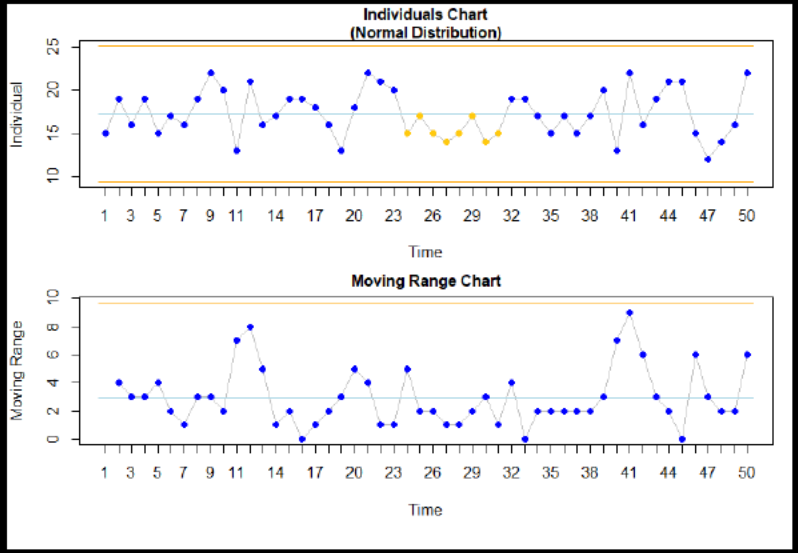
# Control Charts

- Control charts, in and of themselves, will improve nothing.

- **Action** must be taken by the process owner(s).

# Control Charts

- Control Charts provide us with the ability to distinguish between **common** and **special** causes



# Main Applications

1. To monitor output
2. To guide modifications in the improvement of output quality
3. To determine the true capability of a process

# Who Invented Control Charts?

- Dr. Walter Shewhart at Bell Laboratories developed Control Charts in 1924

# Who Invented Control Charts?

The goal was to minimize two types of errors:

- React when we should not (Type I Error)
- Not react when we should (Type II Error)

# When Should We Not React?

Common Causes of Variation

- The inherent variation of the process
- Cannot be improved by "tweaking" (over-adjustment)

# When Should We React?

- When a Special Cause of Variation is present
- Requires immediate attention and investigation

# When Should We React?

The outcome of an investigation leads to:

- Correction to restore the process, with
- Prevention to prevent recurrence; OR
- Incorporation of the special cause, to make the event common to the process

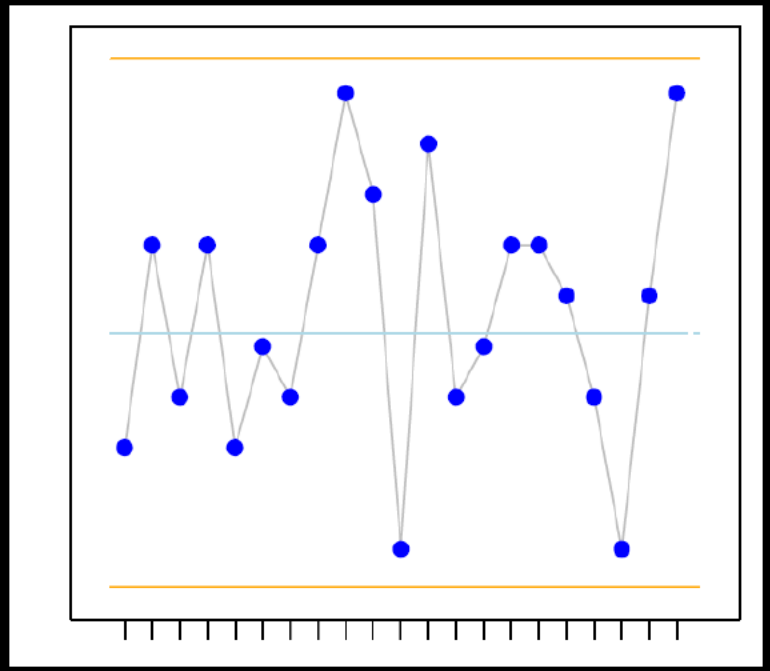
# When Should We React?

- IIAA – Investigate, Identify, take Appropriate Action
- IIPP – Investigate, Identify, Prevent (negative), Propagate (positive)

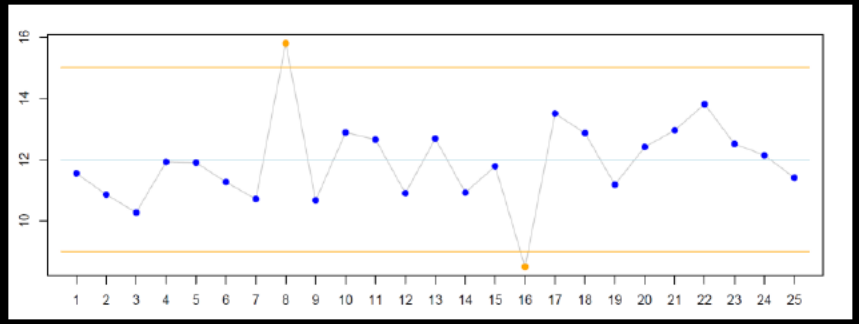
# When Should We React?

- Remember, Special causes that are ignored become part of the process and common cause variability

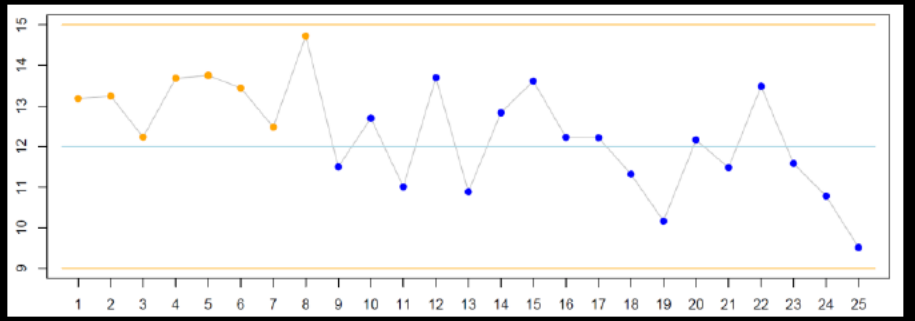
# Anatomy of a Control Chart



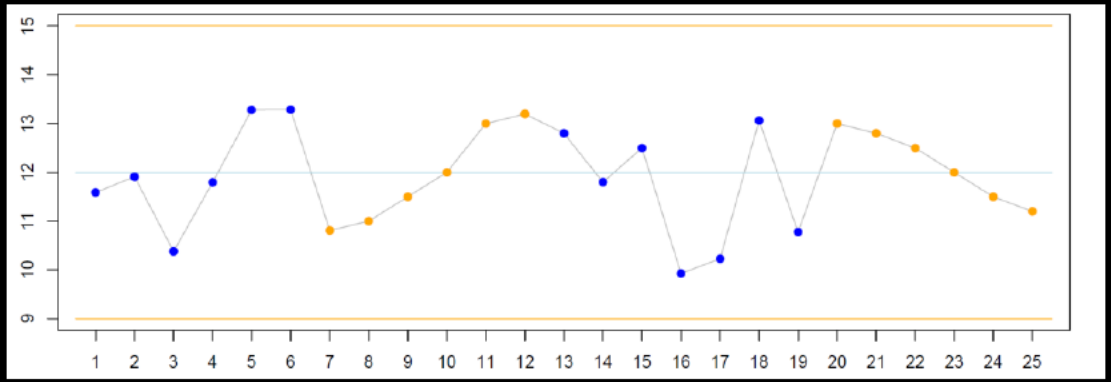
# Some Standard Control Chart Pattern Rules




Points Outside the Limits




Runs (8 points above/below)




Trends (6 increasing/decreasing)

# Common Control Charts

Variables Charts

Location

- (Mean) Chart
- (Median) Chart
- Individuals Chart

Spread

- Range Chart
- Standard Deviation Chart
- Moving Range Chart

# Common Control Charts

Attribute Charts

Proportions
- p Chart
- np Chart

Rates
- c Chart
- u Chart

# 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.
- Luftig, J. A Quality Improvement Strategy for Critical Product and Process Characteristics. Luftig & Associates, Inc. Farmington Hills, MI, 1991
- Luftig, J. Guidelines for Reporting the Capability of Critical Product Characteristics. Anheuser-Busch Companies, St. Louis, MO. 1994
- Spooner-Jordan, V.  Understanding Variation. Luftig & Warren International, Southfield, MI 1996
- 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