# Mean and Standard Deviation Charts

**Data Science for Quality Management: Xbar and R / Xbar and S charts / X and MR charts**

with **Wendy Martin**

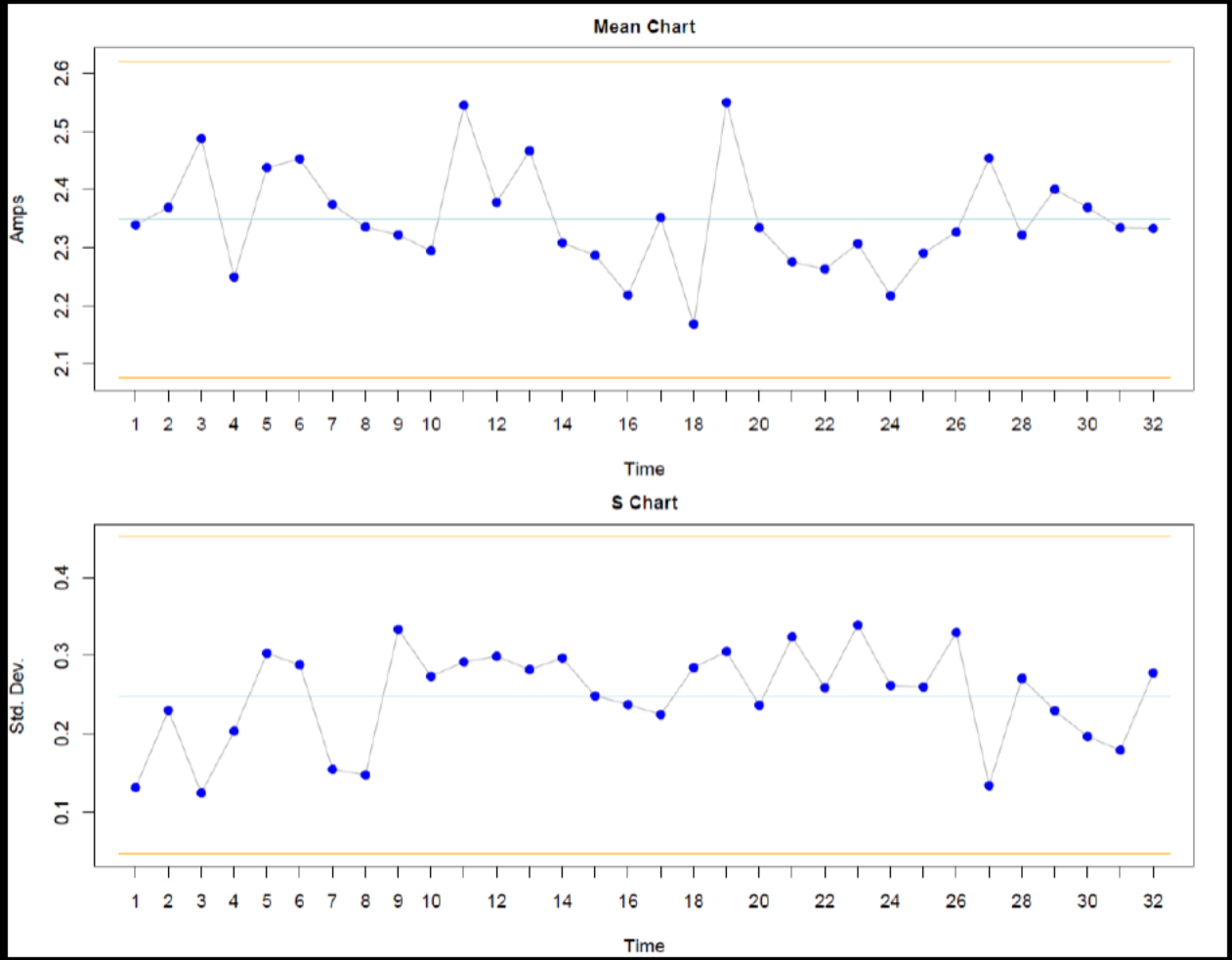
**Learning objectives:**

Create centerlines for the X Bar and S Chart

Calculate control limits for the X Bar and S Chart

# Mean and Standard Deviation

- Like the mean and range chart
- Used when sample size is eight or more
- The s chart reflects dispersion in a way that is less influenced by extreme values than the R chart


Mean Chart
Amps
2.1
2.2
2.3
2.4
2.5
2.6
1 2 3 4 5 6 7 8 9 10 12 14 16 18 20 22 24 26 28 30 32
Time
S Chart
Std. Dev.
0.1
0.2
0.3
0.4
1 2 3 4 5 6 7 8 9 10 12 14 16 18 20 22 24 26 28 30 32
Time

# The Case of the Printed Circuit Board

- Your plant has had some customer concerns with the plating voids on your printed circuit board units.
- Your plant manager has assured the customer that they work correctly but suggests that you investigate the matter

# The Case of the Printed Circuit Board

- You start by assessing the process for control and capability.
- The specifications for the current measurement are 2.5 ± 1.0 amps.
- The supervisor and the lab technician agree to assist you with the initial study of this process.

# Step 1: Select the Characteristic to be Evaluated

- The characteristic is the current in the printed circuit board.

- A standard method for current measurement has been developed, and your measurement system has been found to be acceptable.

# Step 2: Select the Sampling Plan

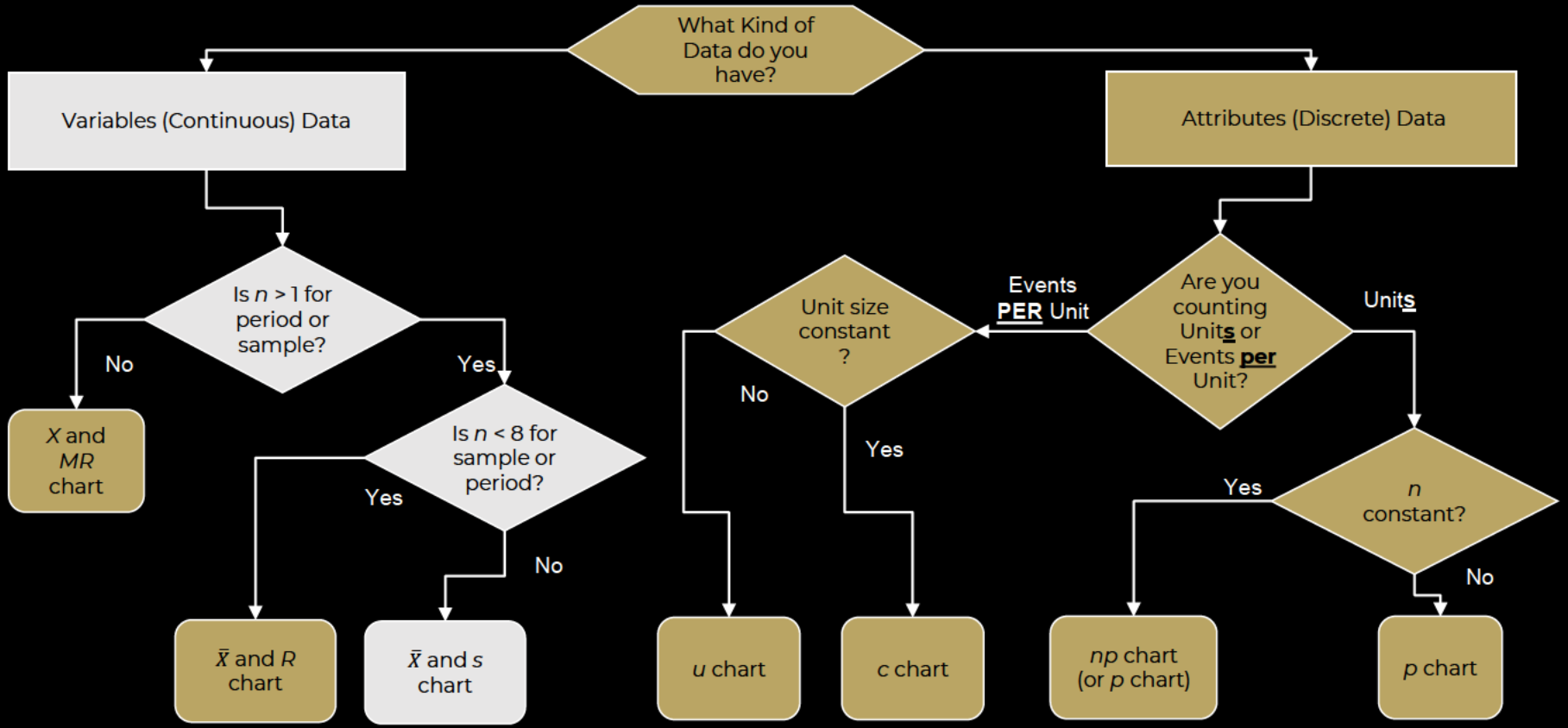
- The lab technician has agreed to make the measurements.
- The assembly process only operates on the day shift.
- You decide to conduct this initial study over two consecutive days.

# Step 2: Select the Sampling Plan

- With variables data and a sample of size eight, you decide to use an $\bar{X}$ and s chart.

- See the selection chart on the next page to verify this selection as the appropriate one.

# Step 3: Select the Chart



# Step 4: Collect the Data

- Data corresponding to 32 (k) samples of size 8 (n) have been collected and entered into a text file named ‘xbar-s’.

# 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