C-chart Control Charts

Steven S Prevette

Senior Statistician
Savannah River Nuclear Solutions, LLC

FLUOR.

SPC Trending Primer/ Two Day Training

http://www.efcog.org/wg/esh_es/Statistical_Process_Control/index.htm

Exercise Description

- You observed me make a C chart of the Red Bead Results

- You will make the same chart today

- We will also generate new data and add to the chart

http://www.efcog.org/wg/esh_es/Statistical_Process_Control/docs/cchart.pdf

Excel Spreadsheet Setup

- **Open Excel Spreadsheet and start a new file**
  - Column Headers "Trial No.", "No. of Red Beads"
- **Column A will be Trial Number (Trial 1 – Trial 24)**
  - Enter "Trial 1" in cell A2
  - Enter "Trial 2" in cell A3
  - Use Autofill to complete the column to Trial 24
- **Enter the number of red beads for each trial in Column B**
- **Reserve Column C as the average, Column D as the Upper Control Limit (UCL), and Column E as the Lower Control Limit (LCL)**

Run Chart

- **Highlight Cells A2 to E25**

- **Hit the F11 key. This will make a bar chart.**

- **Change chart type to line, delete the background, grid lines, and legend**

- **You now have a "run chart", a line chart of the raw data**

Calculate the Baseline Average

- **We will use all of the data for our initial baseline**
  - If there had been more than 25 points, use the first 25
- **=average(B2:B25) is the baseline average**
- **Copy and paste special (values) into the C column**
- **This places a horizontal line on the chart**

Calculate the Standard Deviation

- **The standard deviation for a c-chart is the square root of the average.**

- **This is a special case – the c-chart is used when counting Poisson events**

- **Poisson implies that we count individual events, and occurrence of one event does not affect any other likelihood of occurrence**

- **Poisson works well for counting defects, events, injuries per fixed unit**

Calculate the UCL and LCL

- **In D2, type =C2 + 3 * sqrt(C2)**
- **Copy this down the column**
- **In E2, type =C2 – 3 * sqrt(C2)**
- **Copy this down the column**
- **Check the chart for any trends**

Definition of a Trend

- **One point outside the control limits**
- **Two out of Three points two standard deviations above/below average**
- **Four out of Five points one standard deviation above/below average**
- **Seven points in a row all above/below average**
- **Ten out of Eleven points in a row all above/below average**
- **Seven points in a row all increasing/decreasing.**

This list was developed from US Department of Energy Standard 1048-92 and <u>Quality Control and Industrial Statistics</u> by Acheson Duncan

Clean Up

- **I usually make the average line a heavy black line, and the control limits red and green**

- **Label the Average Line**

- **Add chart title and axis labels**

- **Put your name in the chart footer**

New Data

- **What do we predict the future results to be?**

- **How will we know if something changes?**

- **Let's do a few more days of "production" of white beads**

Adding Data to the Chart

- **Highlight the last row of data**
- **"Insert" a row**
- **Copy the row up into the blank row**
- **Replace the Trial Number on the bottom row, and replace the number of red beads**
- **Check the chart for trends**

Did Anything Change?

- **Have any trends developed?**

- **What do you think has happened?**

- **What is our new prediction for the future?**
  - Generate a new baseline average and control limits