4) Statistical Process Control Charts - C & U Charts

FOSSEE (R Team)

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What is a Statistical Process Control Chart?

In any manufacturing process, the quality of the product is maintained by using a technique known as the **Statistical Process Control.** The method involves collecting data of the raw material used, the manufacturing processes involved, and the final product. Data is mainly extracted from the machines and instruments involved in the manufacturing processes. This collected data, based on its type, is recorded and tracked on various types of control charts. These charts are of different kinds and are collectively known as **Statistical Process Control Charts.** Later, these charts are used to evaluate, monitor and control a process.

What are C & U charts?

The **C & U charts** are used for monitoring the number of defects in items **(C chart)** and defects in samples **(U chart)** respectively. **C chart** is used when the sample size is consistent. **U chart** is used when the sample size varies.

Introduction

The purpose of this experiment is to evaluate a manufacturing process dataset in R, by creating its **C & U charts.**

Procedure

Step by step procedure to conduct the required experiment -

1. Selecting dataset for the creation of **C & U charts**
2. Creation of **C chart**
3. Creation of **U chart**

Note : Please make sure that the following package is already installed -

- qcc

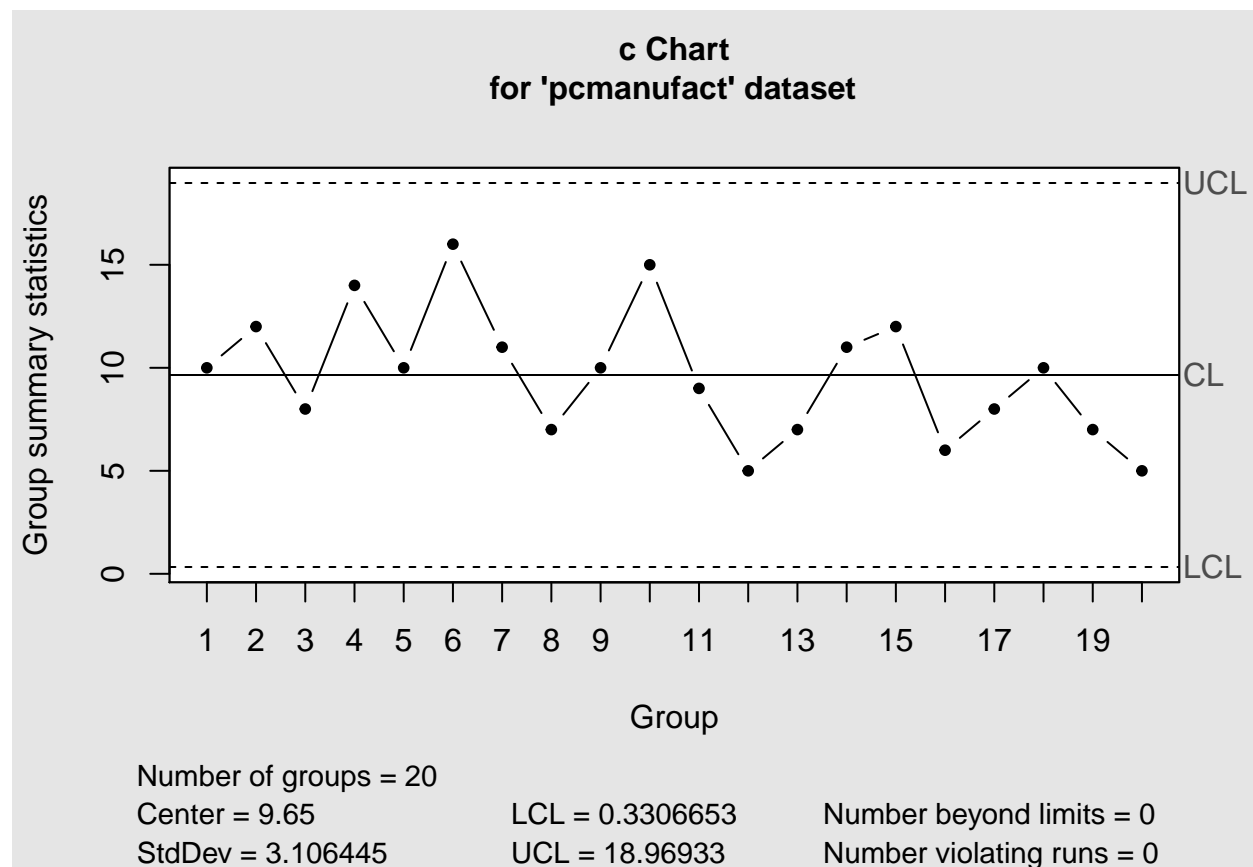## Code and Results

Data used for analysis

```
## R has a predefined dataset with the name "pcmanufact" in the package "qcc"
 # To know more about the dataset, after loading "qcc" package type "?pcmanufact" in the
 # console
```

Selecting dataset for the creation of C & U charts

```
# 1) Selecting appropriate dataset to be used for analysis
# Run the following command after removing "#" if "qcc" package is not installed
# install.packages("qcc")
  library(qcc)
  data(pcmanufact)
```
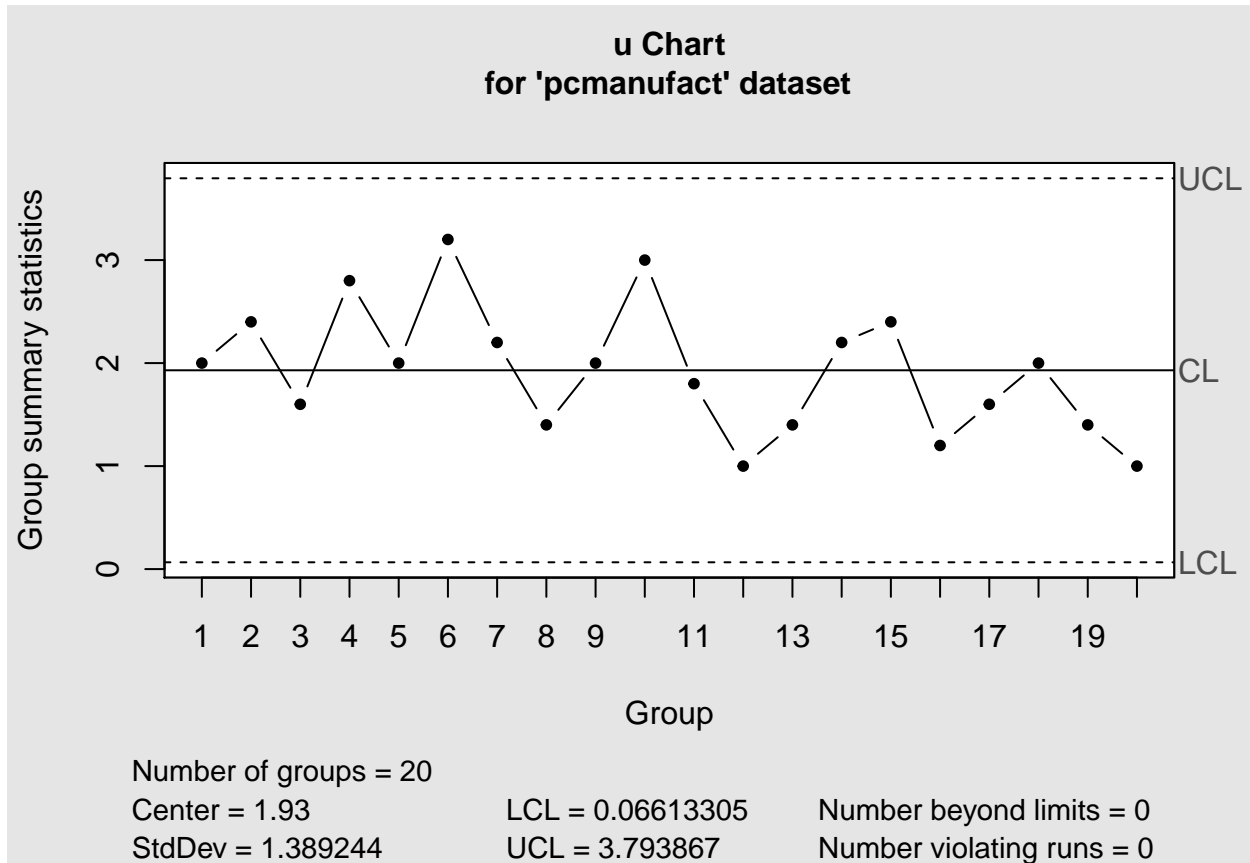
Creation of C chart

```
# 2) Plotting C chart
  chart <- with(pcmanufact ,qcc(x, sizes = size, type="c", data.name =
  paste0(as.character("'"),"pcmanufact",as.character("'")," dataset")))
  plot(chart, chart.all=FALSE)
```

Creation of U chart

```
# 3) Plotting U chart
    chart <- with(pcmanufact ,qcc(x, sizes = size, type="u", data.name =
    paste0(as.character("'"),"pcmanufact",as.character("'")," dataset")))
    plot(chart, chart.all=FALSE)
```

u Chart
for 'pcmanufact' dataset

Number of groups = 20
Center = 1.93   LCL = 0.06613305   Number beyond limits = 0
StdDev = 1.389244   UCL = 3.793867   Number violating runs = 0

Conclusion

In both of the above plots, we can observe that the process is under control as there is no data point which either lies beyond limits or is violating runs.