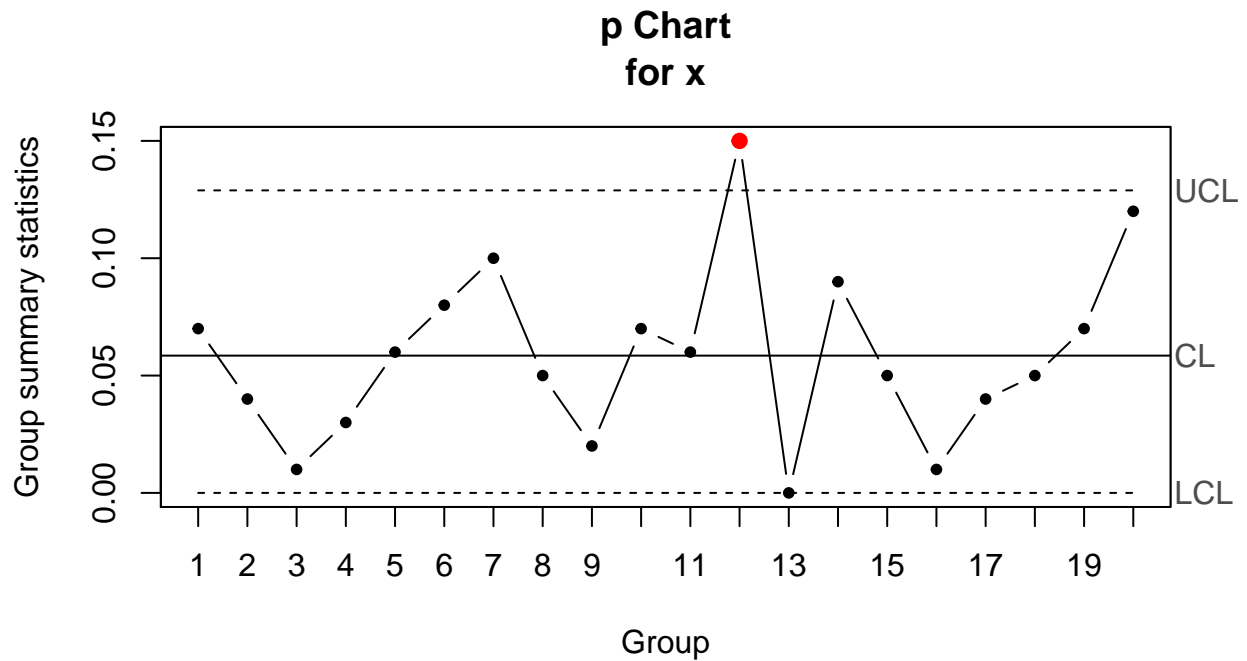# Chapter 7 Homework

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7.1

First we plot the P chart without excluding any data.

**p Chart
for x**

Number of groups = 20

Center = 0.0585	LCL = 0	Number beyond limits = 1
StdDev = 0.2346865	UCL = 0.1289059	Number violating runs = 0

Now we plot the control chart excluding any outlier.

p Chart
for x
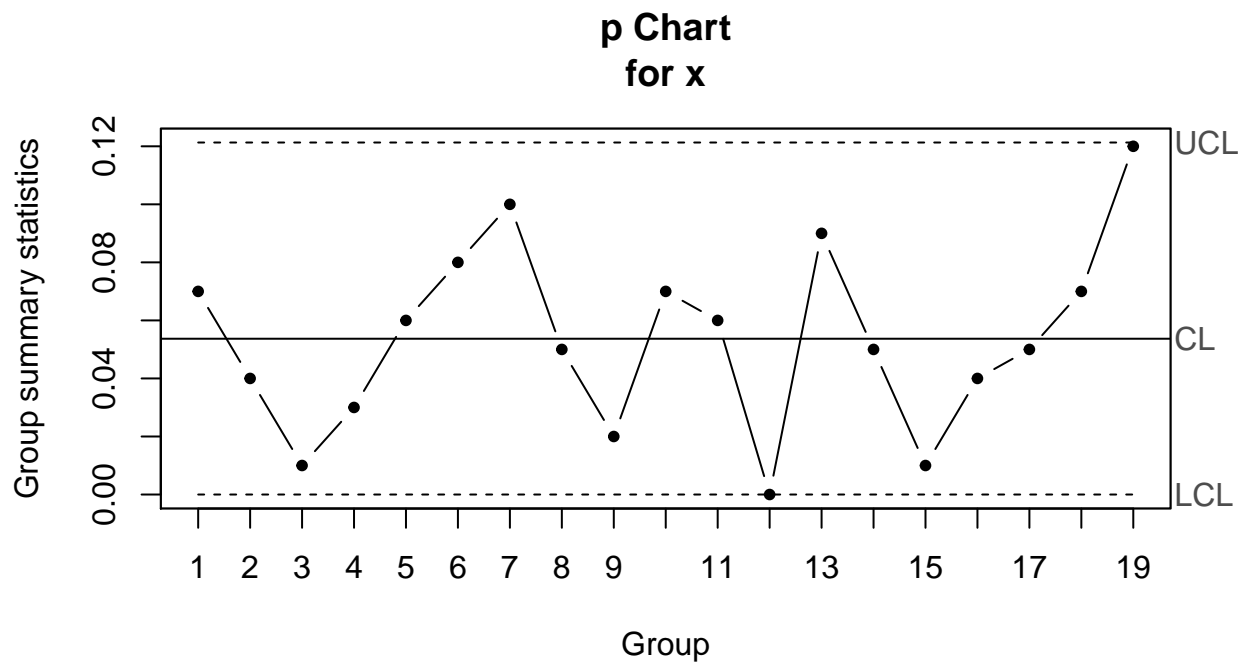
Number of groups = 19
Center = 0.05368421   LCL = 0   Number beyond limits = 0
StdDev = 0.2253935   UCL = 0.1213023   Number violating runs = 0

7.2

p Chart
for x
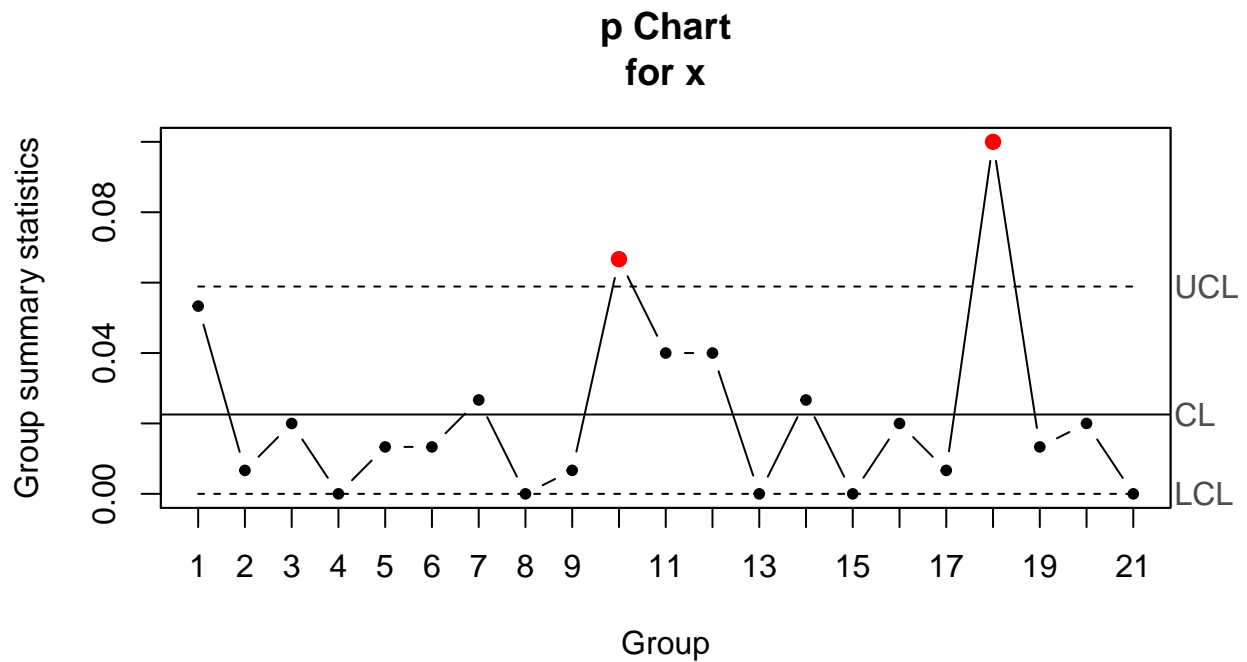
Number of groups = 21
Center = 0.02253968   LCL = 0   Number beyond limits = 2
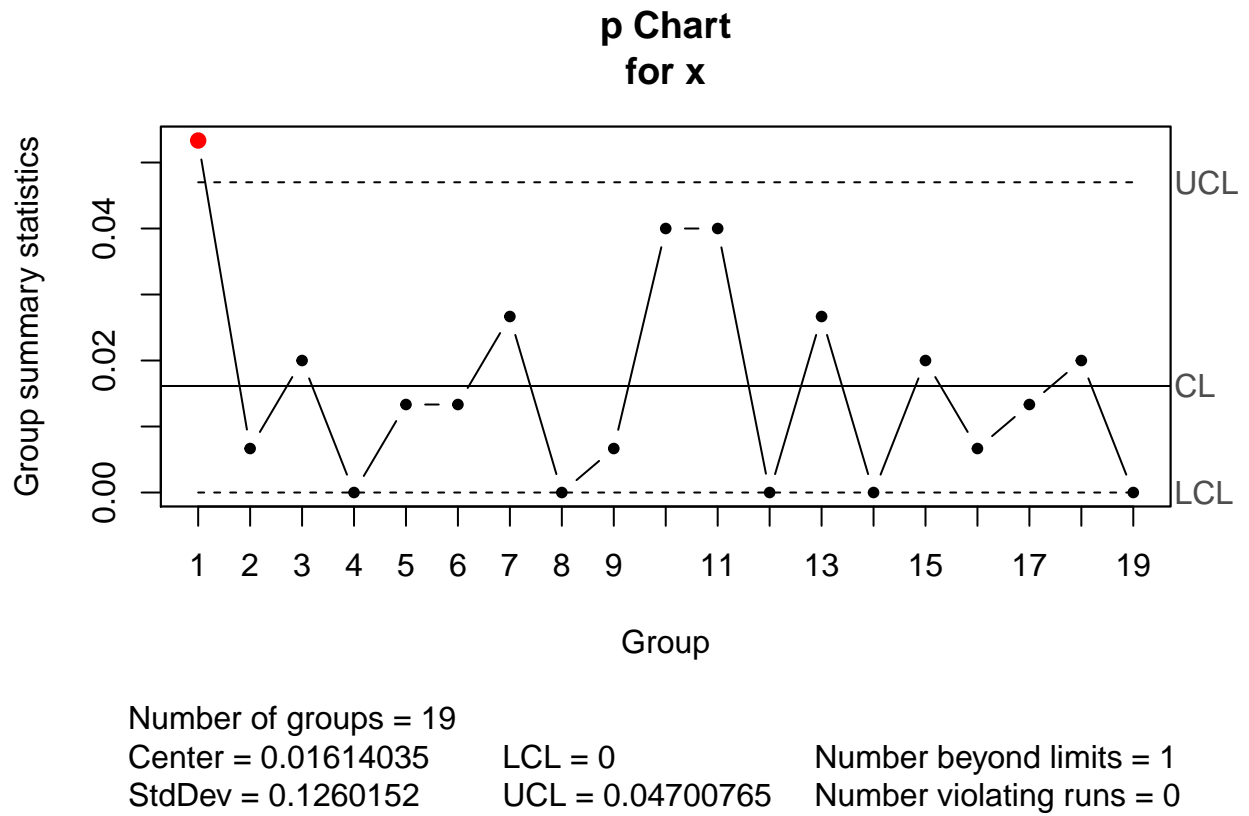StdDev = 0.1484306   UCL = 0.05889761   Number violating runs = 0
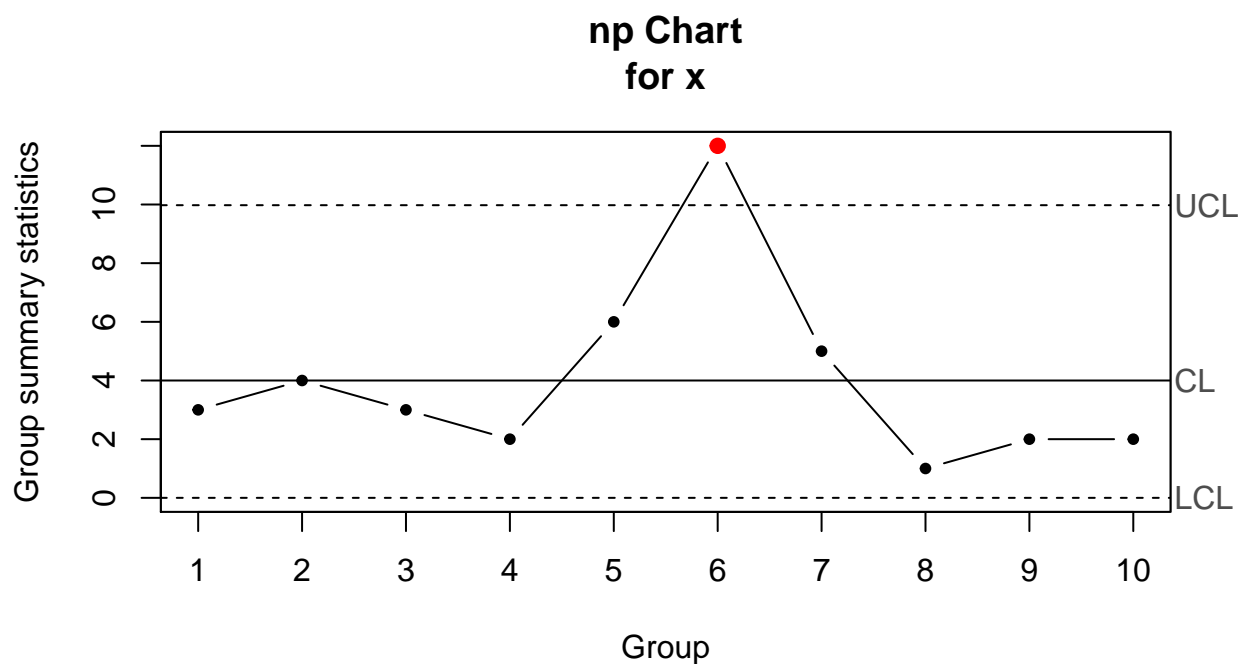
It appears the process is not operating in control. In our samples, there are two samples that are out of control, beyond the UCL, as can be seen from the control chart.

Removing the points that are OOC we get

**p Chart
for x**

Number of groups = 19
Center = 0.01614035   LCL = 0   Number beyond limits = 1
StdDev = 0.1260152   UCL = 0.04700765   Number violating runs = 0

and our new reccomended UCL and LCL are displayed on the chart.

7.6

np Chart
for x

Number of groups = 10
Center = 4   LCL = 0   Number beyond limits = 1
StdDev = 1.991984   UCL = 9.975952   Number violating runs = 0

np Chart
for x
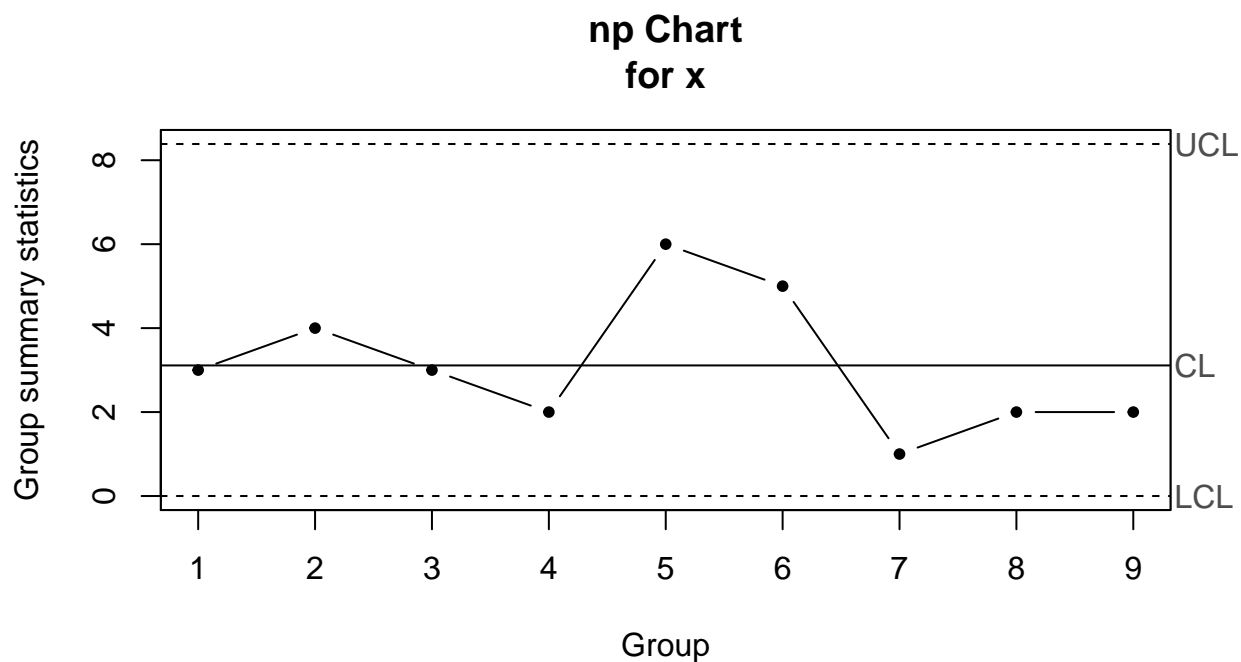
Number of groups = 9
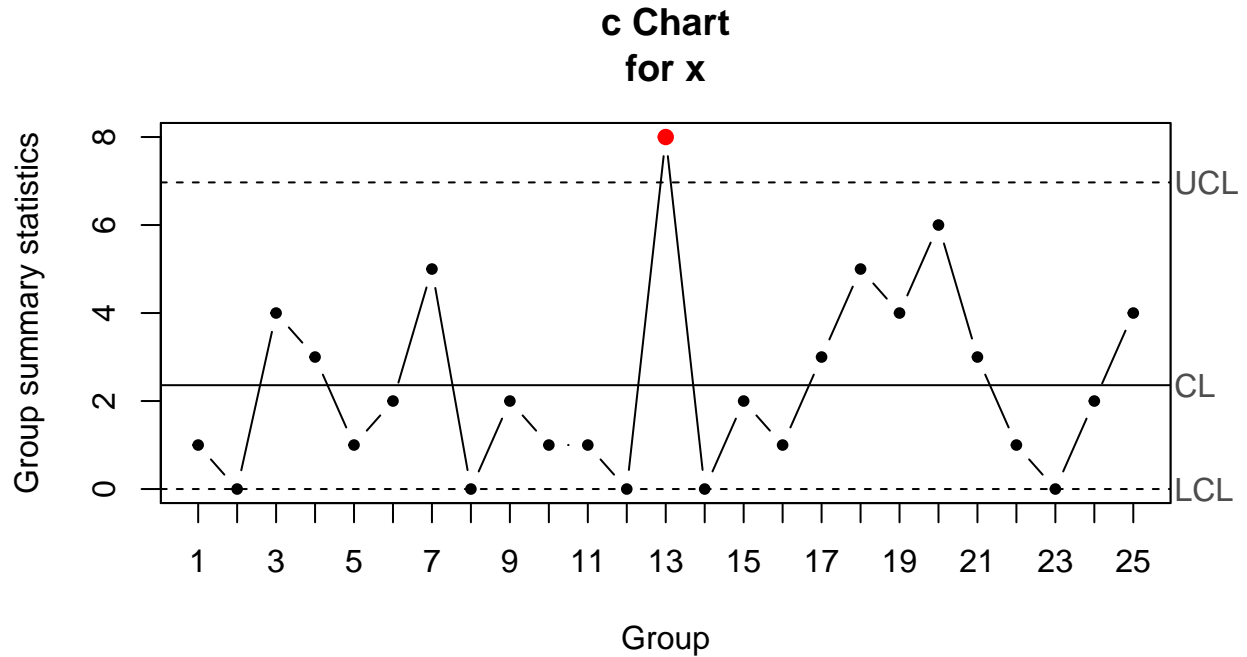Center = 3.111111   LCL = 0   Number beyond limits = 0
StdDev = 1.758338   UCL = 8.386126   Number violating runs = 0

I would reccomend that the UCL = 8.3861256 and LCL = 0. Center line would be 3.1111111. These limits are calculated after having removed the OOC point and then recalculating the statistics.

7.36

c Chart
for x

Number of groups = 25
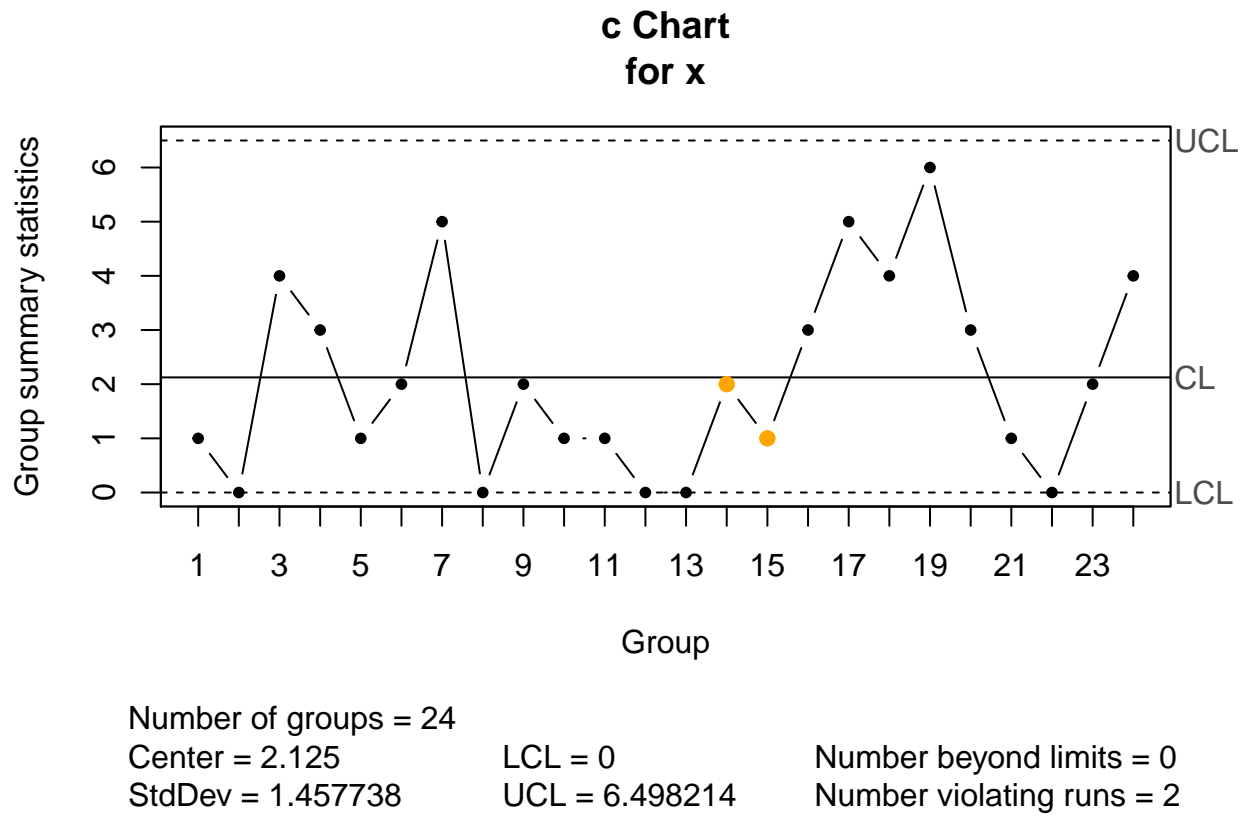Center = 2.36   LCL = 0   Number beyond limits = 1
StdDev = 1.536229   UCL = 6.968687   Number violating runs = 0

No. The process is not in control. There is one point that is beyond the upper control limit. We can recompute the limits after removing the point that is OOC and report these new limits as the recommened ones.

c Chart
for x

Number of groups = 24

Center = 2.125	LCL = 0	Number beyond limits = 0
StdDev = 1.457738	UCL = 6.498214	Number violating runs = 2

Looking at this chart, the two yellow points are warnings per the Shewhart Rules, i.e. a run of 7 points below or above the center line. Investigation may be warranted.

7.41

c Chart
for x
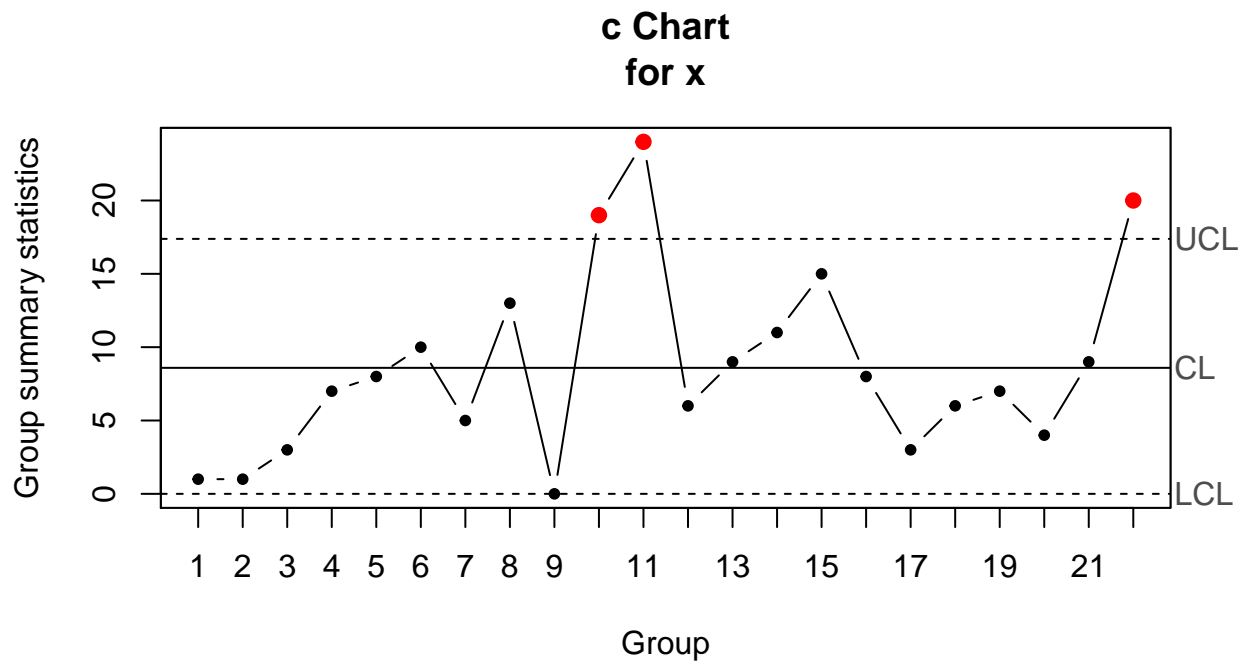
Number of groups = 22
Center = 8.590909   LCL = 0   Number beyond limits = 3
StdDev = 2.931025   UCL = 17.38398   Number violating runs = 0

The process has 3 ooc points one of which is the most recent sample. The process is NOT in statistical control.

7.43

7.44