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Internet Quality Control Check

Description of Data:

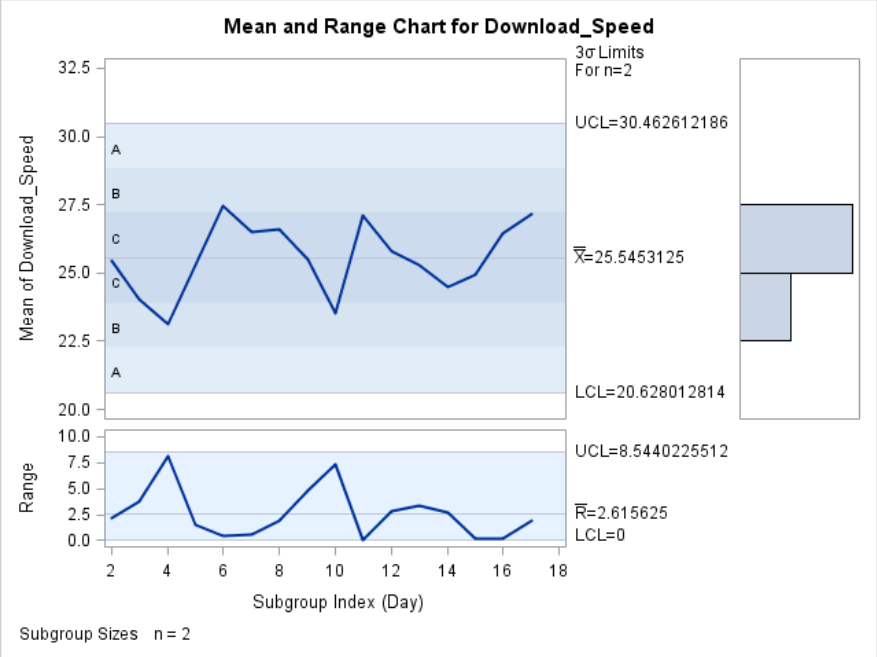
While browsing the internet, I often get the impression that my connection has a mind of its own, in the sense that the same webpages appears to load content at different speeds on different occasions that I visit them. I decided to use Statistical Quality Control to test this hypothesis. I decided to measure upload and download speeds daily in order to see if my intuition had any merit or not. The tool I used to collect this data is the website http://www.speedtest.net/, which allows the user to send a ping from their computer to a remote server and test download and upload speeds.

Data Collection:

Between the days of April 2nd, 2017 and April 17th, 2017 (inclusive), I used the Speed Test tool to measure my upload and download speeds (in Mbps) twice a day, once at 8:00 PM and once at 8:30 PM. Since I am primarily interested in the loading of content, I decided to make my primary variable of interest download speed, which is a measurement variable whose unit is Megabits per second (Mbps). I note that my data gives me 16 samples, each with a sample size of n = 2 samples. Each observation was recorded in Excel. I listed my table of observations in the Data Appendix at the end of this document.

Analysis:

First, I renamed some of my variable names for simplicity and then uploaded these tabulated results onto SAS. Since I am using measurement data and I have a sample size of n = 2, which is greater than 1, I must make use of either use the $\bar{X}$ and R chart or the $\bar{X}$ and S chart. I decide to opt for using the $\bar{X}$ and R chart. First, I sorted my observation by Day, which was the indicator for which sample an observation was a part of. Next, I made use of the PROC SHEWHART subroutine in SAS and created the $\bar{X}$ and R chart. I show this below:



Looking at the R chart first, we note that there are no out of control observations and no obvious non-random patterns in the data. Next, looking at the $\bar{X}$ chart, we also notice that there are no out of control observations and there are no obvious non-random patterns. The data does not appear to drift too far from the Grand Mean Download Speed of 25.545 Mbps. This would lead me to believe that the process of download speeds on my computer appears to be in control.

Conclusion:

I measured my internet download speeds from April 2nd to April 17th using the Speed Test tool. Since my data is measurement data with sample sizes of greater than 1, I made use of the $\bar{X}$ and R Charts. For both charts, I found that there were no out of control observations and no non-random patterns. Based on this, I conclude that my internet download speed process is in control. Going back to the original topic of interest, this would lead me to believe that my Internet Download Speeds do not appear to have a large amount of variation, as I had originally theorized. However, I do note that I only used measurements at the same timeframe (8 and 8:30 PM) for each of these days. It is very possible that if I had decided to measure my internet speeds at different times of day, then my results may have differed. This is something that I may use in future research of this topic.

SAS Code:

```
/*Stat Quality Control HW 4*/
libname hw4 'C:\Users\Owner\Documents\Grad School\MS Statistics\Spring
2017\Stat Quality Control\HW\HW 4';
PROC IMPORT OUT= hw4.internet
                  DATAFILE= "C:\Users\Owner\Documents\Grad School\MS
Statistics\Spring 2017\Stat Quality Control\HW\HW 4\internetdata.csv"
            DBMS=CSV REPLACE;
     GETNAMES=YES;
RUN;
PROC SORT DATA = hw4.internet out = hw4.internet_sorted;
by Day;
run;
PROC SHEWHART DATA = hw4.internet_sorted;
      xrchart Download_Speed * Day /
            zones
            zonelabels
            tests = 1 to 8
            rtmplot = histogram;
run;
```

Data:

Month	Day	Hour	Minute	Ping (ms)	Download Speed (mbps)	Upload Speed (mbps)
4	2	20	0	13	26.52	38.08
4	2	20	30	14	24.35	37.78
4	3	20	0	13	22.14	37.29
4	3	20	30	13	25.94	37.23
4	4	20	0	12	27.2	37.64
4	4	20	30	13	19.08	35.59
4	5	20	0	12	24.58	37.26
4	5	20	30	13	26.04	36.71
4	6	20	0	12	27.25	37.68
4	6	20	30	12	27.68	37.46
4	7	20	0	12	26.25	38.04
4	7	20	30	12	26.8	37.33
4	8	20	0	12	25.66	37.42
4	8	20	30	13	27.58	37.43
4	9	20	0	12	27.87	36.85
4	9	20	30	13	23.07	34.99
4	10	20	0	14	19.86	37.28
4	10	20	30	13	27.19	37.54
4	11	20	0	13	27.09	37.62
4	11	20	30	12	27.14	37.48
4	12	20	0	12	27.21	37.69
4	12	20	30	12	24.38	37.55
4	13	20	0	12	26.97	37.39
4	13	20	30	12	23.61	37.84
4	14	20	0	12	23.12	37.72
4	14	20	30	12	25.84	37.11
4	15	20	0	13	25.02	37.43
4	15	20	30	12	24.81	37.51
4	16	20	0	12	26.35	37.44
4	16	20	30	12	26.56	32.57
4	17	20	0	12	26.2	37.56
4	17	20	30	12	28.09	37.7