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Homework #9 – Statistical Thinking and Applications

TECH 50000 - Quality Standards

Saturday, March 12, 2011

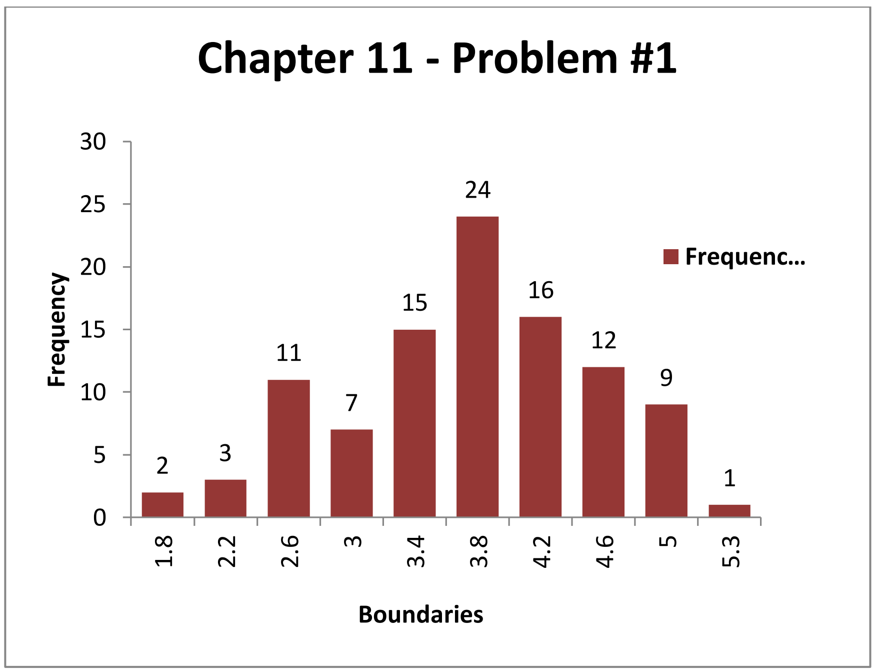
Chapter 11

Problems

1. Apply the Descriptive Statistics and Histogram analysis tools in Excel to compute the mean, standard deviation, and other relevant statistics, as well as a frequency distribution and histogram for the data found in the Prob. 11-1, Excel data set. From what type of distribution might you suspect the data are drawn?

It took me a little while, but with a little research, I figured out I think I figured out how to determine the bins and their intervals. I also found that it was best to take all the data from all ten columns and place them into one column. From what I can tell by looking at the charts is that, although there is slight skewness to the left, these data are drawn from a fairly normal distribution. My analyses using the tools in Excel are as follows:

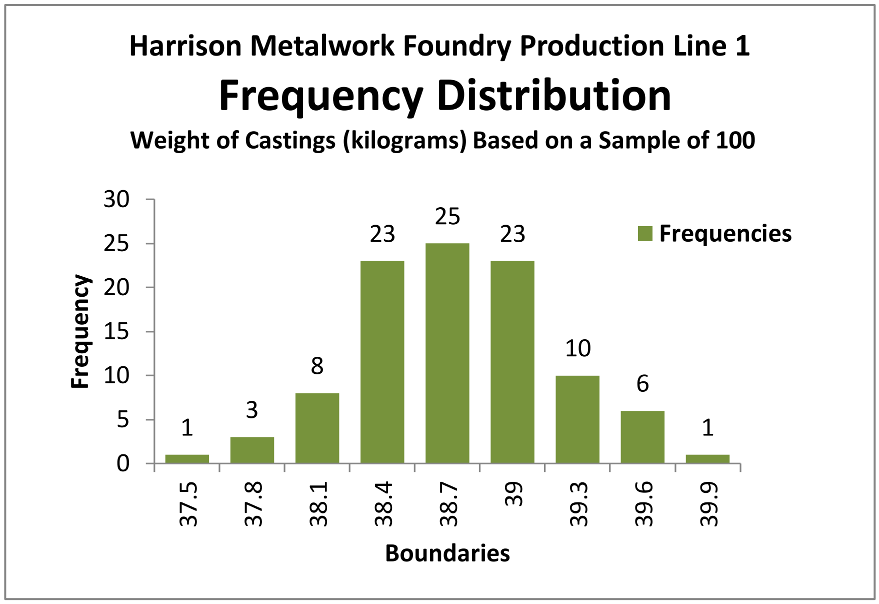
Descriptive Statistics	
Mean	3.5910
Standard Error	0.0809
Median	3.6500
Mode	3.6000
Standard Deviation	0.8088
Sample Variance	0.6542
Kurtosis	-0.2919
Skewness	-0.2404
Range	3.6000
Minimum	1.7000
Maximum	5.3000
Sum	359.1000
Count	100.0000
Confidence Level (95.0%)	0.1605



3. The data (Prob. 11-3 in C11Data.xls) show the weight of castings (in kilograms) being made in the Harrison Metalwork foundry and were taken from one production line. Compute the mean, standard deviation, and other relevant statistics, as well as a frequency distribution and histogram. Based on this sample of 100 castings, what do you conclude from your analysis?

The descriptive statistics and histogram that I computed from the raw data in Prob. 11-3 in C11Data.xls using Excel's analysis tools is shown below. Based on the sample of 100 castings obtained from Harrison Metalwork Foundry's production line, I would say that although there is a minor skewing to the right, the distribution of the data seems to be fairly normal.

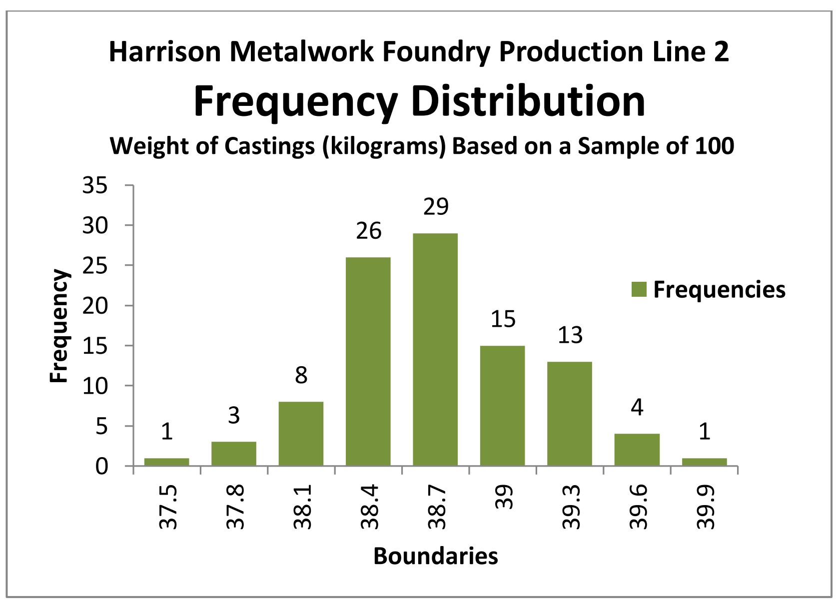
Descriptive Statistics	
Mean	38.6700
Standard Error	0.0456
Median	38.7000
Mode	38.4000
Standard Deviation	0.4556
Sample Variance	0.2076
Kurtosis	0.3747
Skewness	-0.1715
Range	2.6000
Minimum	37.3000
Maximum	39.9000
Sum	3867.0000
Count	100.0000
Confidence Level (95.0%)	0.0904



4. The data (Prob. 11-4 C11Data.xls) represents the weight of castings (in kilograms) from another production line in the Harrison Metalwork foundry. Based on this sample of 100 castings, compute the mean, standard deviation, and other relevant statistics, as well as a frequency distribution and histogram. What do you conclude from your analysis?

My analysis of the raw data for this production line, which is shown below, tells me that this is data is also distributed fairly normal. This data also has a slight skewing to the right; however, it is not as much as that of the data from the production line in problem three. The standard error is less in this production line than that of problem three, with a difference of 0.0012.

Descriptive Statistics	
Mean	38.6320
Standard Error	0.0444
Median	38.6000
Mode	38.4000
Standard Deviation	0.4436
Sample Variance	0.1967
Kurtosis	0.5580
Skewness	-0.0247
Range	2.6000
Minimum	37.3000
Maximum	39.9000
Sum	3863.2000
Count	100.0000
Confidence Level (95.0%)	0.0880



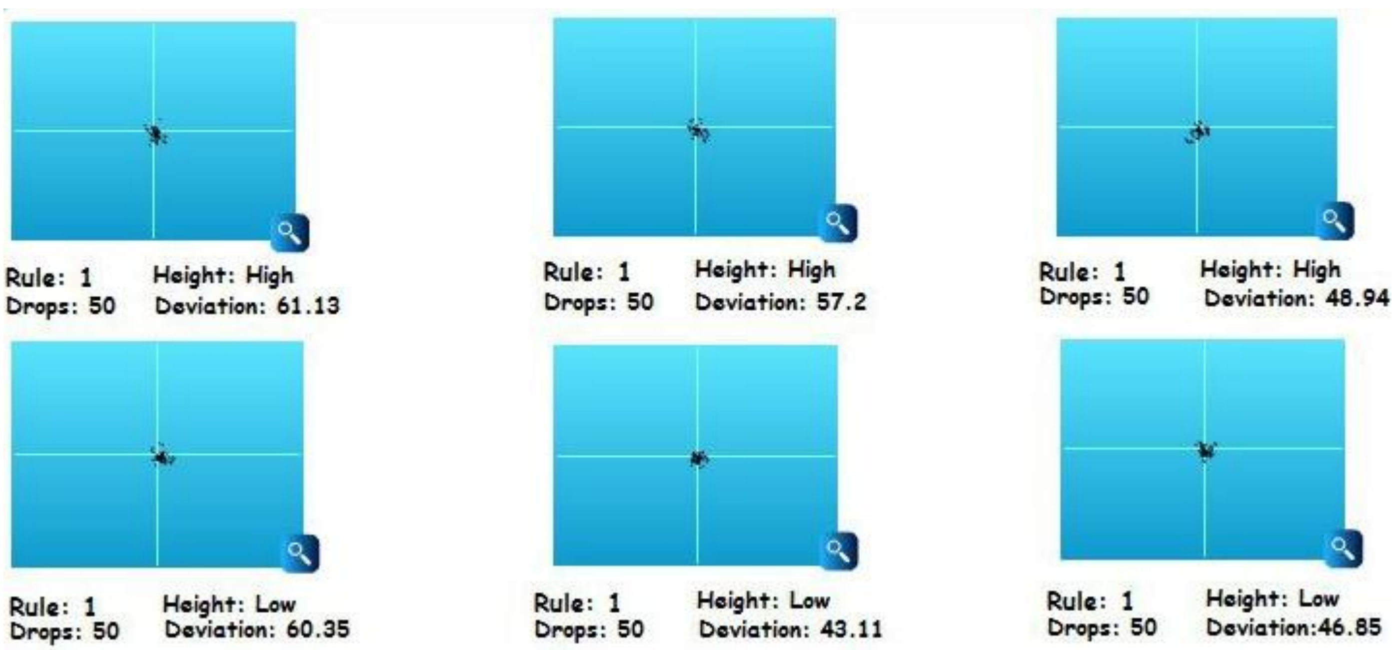
Project

1. **A computer version of Deming's Funnel Exercise is available (free) at http://www.symphonytech.com/funnelexp.htm. Run the funnel simulation. Does it simulate the same rules in this chapter?**

It might sound funny saying this, but after reading about the funnel experiment in our textbook, the first thing came to my mind was bowling and playing pool. I think you can compare this experiment to bowling and playing pool in terms of moving the funnel in different directions. For example, the funnel experiment is trying to show us that people will sometime try to decrease variation and improve results by moving the funnel. A bowler will do the same, in terms of standing in different positions or adding a twist when casting the ball down the lane. A pool player will try to hit a ball into the pocket by using combination techniques such as hitting a different ball first, other than the one they want to land in the pocket. The first ball hit will roll on to hit another which will roll on to finally hit the one they want to land in the pocket, and hopefully it will. There are no guarantees. Some techniques work causing better results, while others will cause worse results. As for the online simulation of Deming's funnel experiment, my answers to whether or not it simulates the rules are listed below, including the rule. When using this simulation, I used both scenarios (high and low) for testing each rule six times; three for low and three for high. Doing so showed me how differently things can turn out when manipulated. Below each rule is a screenshot of the simulation summary. Please note that these charts are listed in reverse order of runs. From what I see, after running this simulation, is that it does relate to the rules in our chapter.

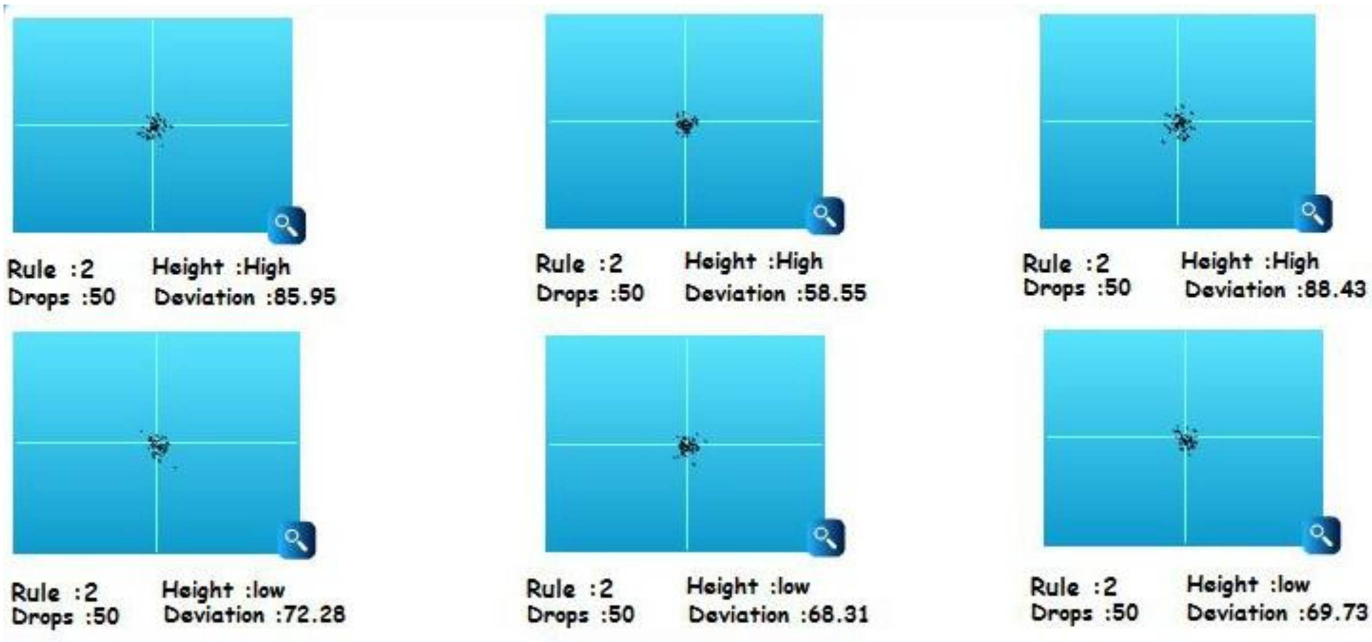
Rule:1) Simply leave the funnel alone, which creates some variation of points around the target.

With the funnel's position set at (0,0), drop number set at 50, and the drop height set at low, all 50 marbles were very close to target with a standard deviation of 46.85. I repeated this simulation at the same settings several times and the standard deviation was different for each, however, the marbles still stayed very close to the target each time. I then changed the drop height to high, leaving all other settings as they were and ended with a standard deviation of 48.94. I ran this simulation at this setting several more times with the same results as those when the drop height was set to low. Although most marbles were close to target, setting the drop height to high caused more to spread out. The ending charts in both settings looked close to the chart for this rule in our book.



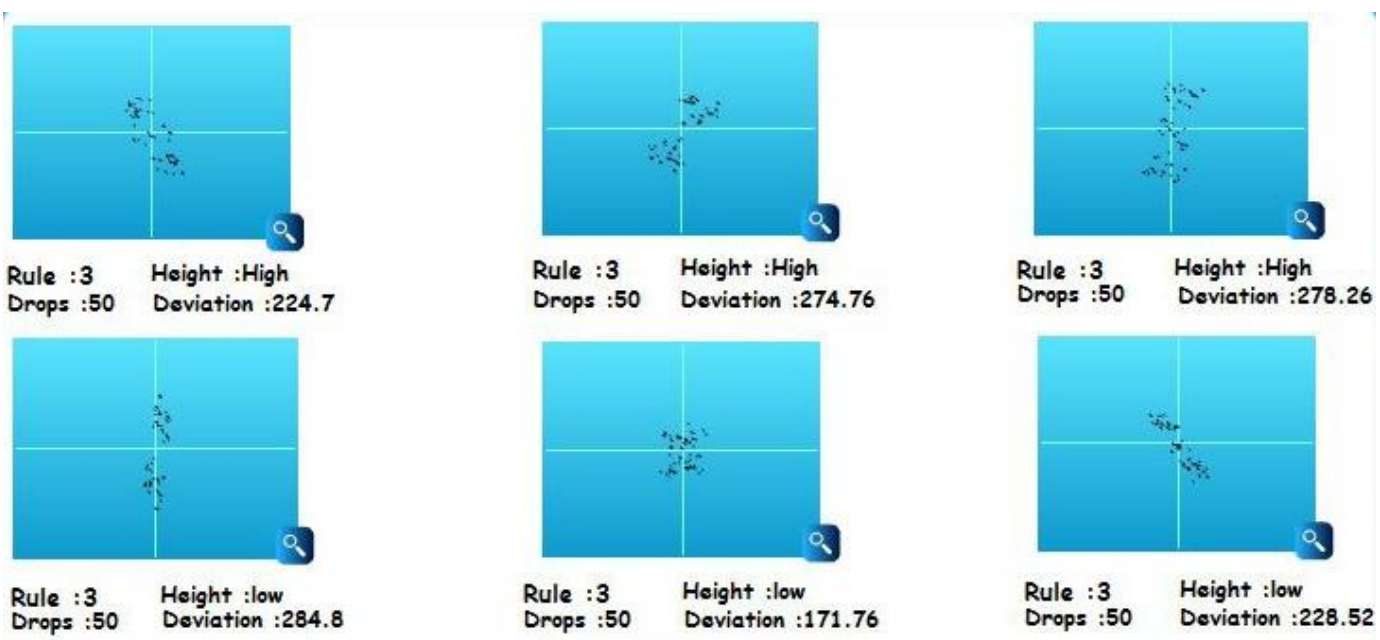
Rule:2) Measure the deviation from the point at which the marble comes to rest and the target. Move the funnel in an equal distance in the opposite direction from its current position.

When running the simulation for this rule, I left the drop amount at 50 and set the drop height to low. My first run showed a standard deviation of 69.73. After two more runs at this setting, the standard deviation changed each time, however, I can see how the resulting chart matches the one for rule two in our textbook. I then ran the same rule with the drop height set at high. This time, the marbles spread out from the target even more so that those set at a low drop height. My first simulation at this setting ended with a standard deviation of 88.43. The standard deviation dropped dramatically in the second run at this setting ending at 58.55. The third run at this setting ended with a standard deviation of 85.95. for this rule is seems that a low drop height is best.



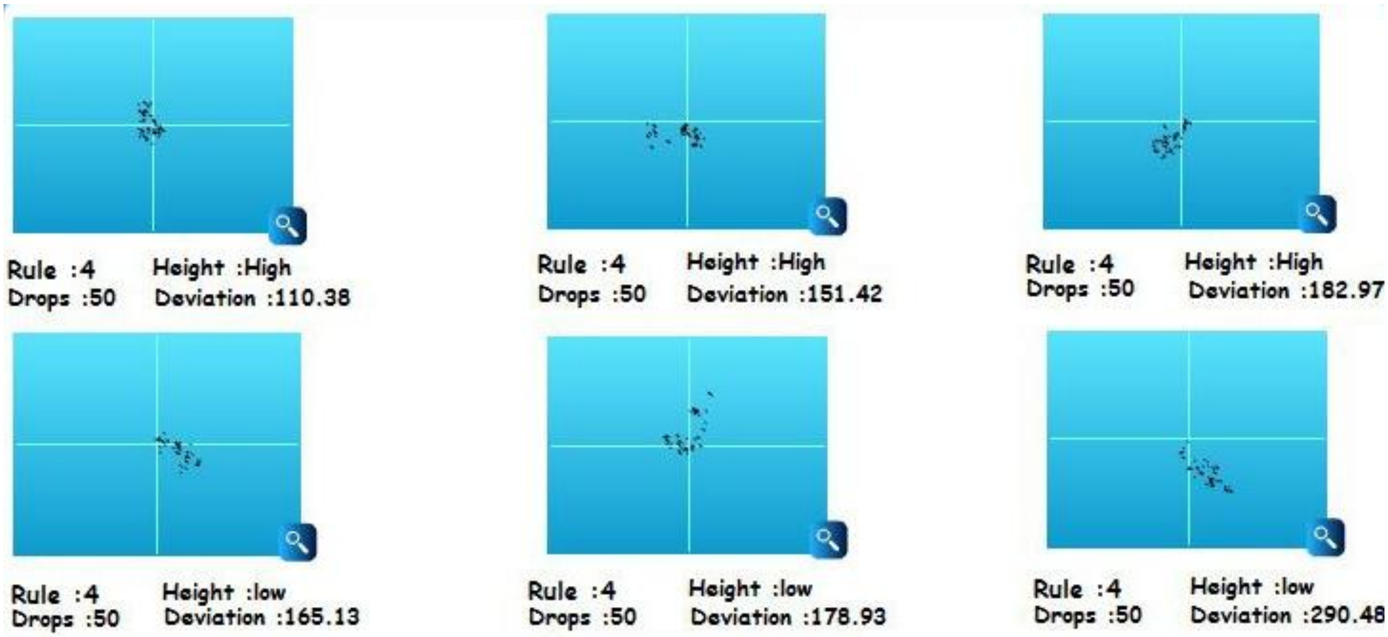
Rule:3) Measure the deviation from the point at which the marble comes to rest and the target. Set the funnel an equal distance in the opposite direction of the error from the target.

For this rule I ran the simulation three times as I did in each of the other rules. The first three runs were set at a low drop height. The first run ended with a standard deviation of 228.52; the second ended with 171.76; and the third ended with 284.8. The last three runs for this rule were set with a drop height of high. The first run ended with a standard deviation of 278.26; the second ended with 274.76; and the third ended with 224.7. I'm not so sure that drop height makes much of a difference for this rule.



Rule:4) Place the funnel over the spot where the marble last came to rest.

I ran the simulation three times each for drop height for this rule as well. The first three simulations were set at a low drop height. The first simulation ended with a standard deviation of 290.48; the second at 178.93; and the third at 165.12. The second two at this setting dropped dramatically from the first. The second set of three simulations with a drop height set to high caused the first simulation to end with a standard deviation of 182.97; the second at 151.42; and the third at 110.38. It seems to me that a high drop setting is best for this rule.



Case

1. **A local delivery service has 40 drivers who deliver packages throughout the metropolitan area. Occasionally, drivers make mistakes, such as entering the wrong package number on a shipping document, failing to get a signature, and so on. A total of 240 mistakes were made in one year as shown in Table 11.9. The manager in charge of this operation has issued disciplinary citations to drivers for each mistake.**

   1) **What is your opinion of the manager's approach? How does it compare with the Deming philosophy?**

      I think the manager's approach is wrong because it is obvious that the mistakes the drivers are making are merely common causes which are causing variation in the system. I look at this situation as a comparison to Deming's Red Bead experiment. Issuing disciplinary citations to drivers for each mistake is beyond ridiculous. This is not a case that can be compared to Deming's Funnel experiment because the drivers are not tampering with the process intentionally. As our textbook states, "To rank or appraise people arbitrarily is demoralizing, especially when workers cannot influence the outcomes." That is exactly what this manager is doing. According to Deming's philosophy, this is considered bad management. Especially since management created the system, therefore, management is responsible for it.

   2) **How might the analysis of these data help the manager to understand the variation in the system? (Plot the data to obtain some insight.) How can the data help the manager to improve the performance of this system?**

      Considering the fact that all processes have some degree of variation, if the system is stable, variations can be predicted by analyzing the data. I constructed the following two charts using the data for this particular case which is listed on page 584 of the textbook in Table 11.9. They do not predict the future, but are a start in terms of defining problem areas. The first chart plots each driver's number of errors by order of driver, as well as the average number of errors. You can easily determine the average number of errors by dividing the total number of errors by the total number of drivers; therefore, 240/40=6. The second chart shows each driver's number of errors as well; however, I made this chart to order each driver by number of errors in descending order, which makes it easier to see which drivers have the highest rate of errors. I hope that made sense! According to these charts, there are 12 drivers who have an error rate above the average six. While most of these errors may be uncontrollable on the driver's part, management could use this data to see which drivers are having the most problems with errors and then drill down to see why. Maybe they need more training, or they are working too many hours. If these are the types of things causing the drivers to perform less accurately, then they are special causes that management can possibly fix.