STUDY GUIDE FOR LESSON 2 EXAM!!! YOU GOT THIS!!!

NEED TO KNOW:

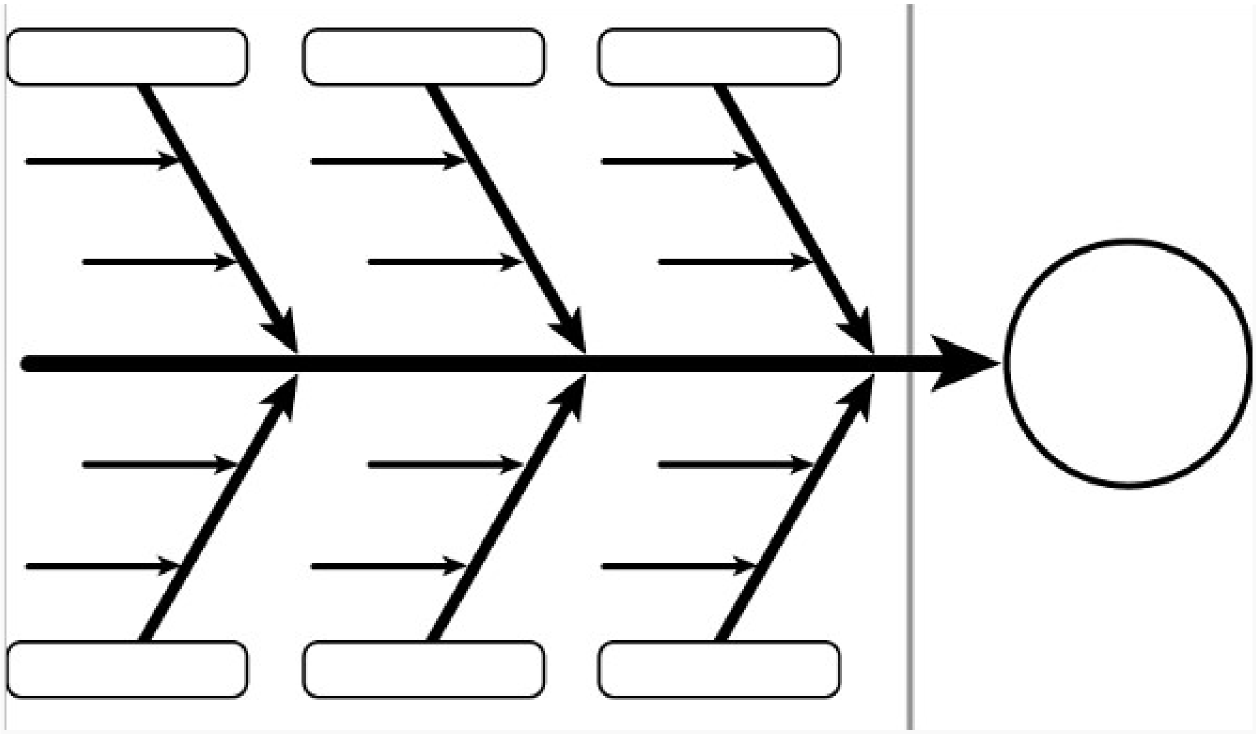
# Deming Approach to Process Control

W. Edwards Deming was an engineer who in the 1950s became world famous. Deming tried to implement Shewhart's ideas, along with a few of his own, into many industries in America. He was largely unsuccessful. However, at the end of World War II, when much of Japan was simply broken, Deming was called upon to integrate this method into business in Japan. Deming's methods of statistical process control were adopted in many industries in Japan, and his status became that of a "geeky rock star" throughout the country. The willingness of the Japanese to adopt his philosophy of controlling quality helped the Japanese to quickly become known for their high-quality products. It wasn't until 20 years of Japanese domination in the reputation for high-quality goods that other countries - including America - decided to adopt the same practices the Japanese had been using.

KNOW ABOUT THE FISHBONE DIAGRAM:

# Cause-and-Effect Diagram

Another basic quality tool is called the *cause-and-effect diagram*. This is also known as the *fishbone diagram*. It was invented by a man named Kaoru Ishikawa. It is not so much a way of collecting data or displaying data as it is a method for determining possible causes for a problem you're facing. It requires a bit of expertise, or at least pretty thorough knowledge of the process, in order to accurately fill out the diagram. Here is what a typical fishbone diagram template looks like:

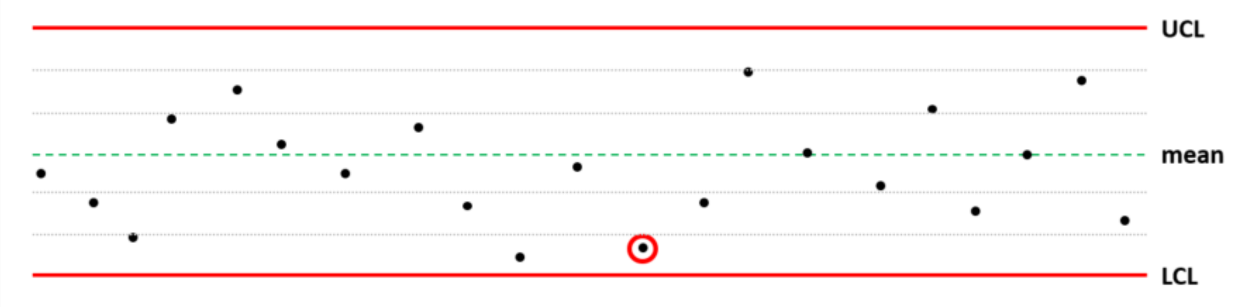


On the main horizontal line, some sort of defect or problem is listed. This is the "effect" part of the "cause-and-effect" diagram. Then, on the angled lines coming into the main horizontal line (both from the top and the bottom), you list all the factors you can think of that would contribute to the effect that is the focus of the fishbone diagram. Each angled line has a specific group of potential "causes."

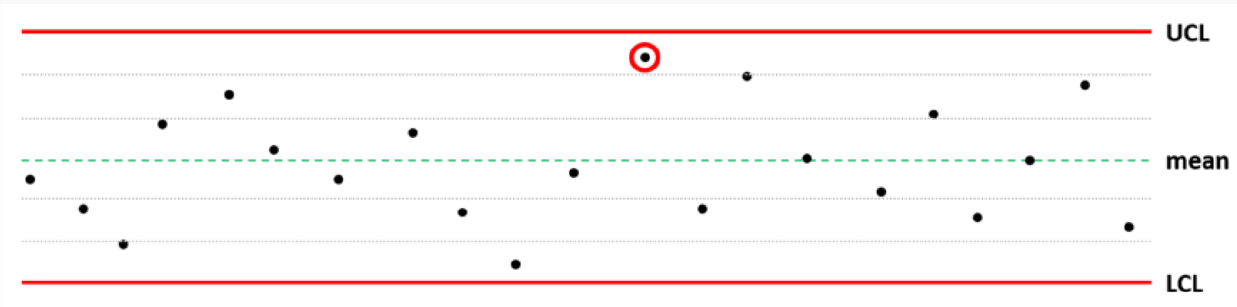
KNOW THIS RULE:

# 2 out of 3 consecutive points that are two or more standard deviations away from the mean**

In the image below, to make it a little easier to see what is going on, 4 additional horizontal lines have been added to the control chart. They are not labeled, but are at one and two standard deviations above and below the mean. Again, the violation is indicated by the red circle. Note that the violation is not displayed by circling all three points that contribute to the violation. With the first two points, there is no violation. The rule violation didn't occur until the third point showed up.




For this rule, the two points that are at least 2 standard deviations away from the mean don't have to be on the same side in order for it to be a violation. So the image below is also a violation of the rule:




# Continuous Process Adjustment Doesn't Work!

However, a man named Walter Shewhart discovered that there are usually many sources of variation in any process. He also discovered that the method of continual process adjustment **typically *increases* the overall variation of the process**, rather than decreasing it.

Why does this happen? **It is called *tampering***, and in layman's terms, it is **an over-reaction to the normal variation present in all processes.** So ironically, continual process adjustment was thought to make variation smaller, because the operator is "nipping the variation in the bud," so to speak, but the actual result is more variation.

# Control Chart Rules

The exercise of plotting data is great, but the real value in using control charts comes when you apply the control chart rules. There are several control chart rules. All of these rules are based upon probability and the normal distribution.

Since the limits of the control chart are at mean plus or minus three standard deviations, and using the 68-95-99 rule, you know that it is very unlikely for a single data point to be outside of the control limits. In fact, the probability of a single data point being outside of the control limits is approximately 0.003, or about 0.3 per cent. That low a probability means something isn't quite right!

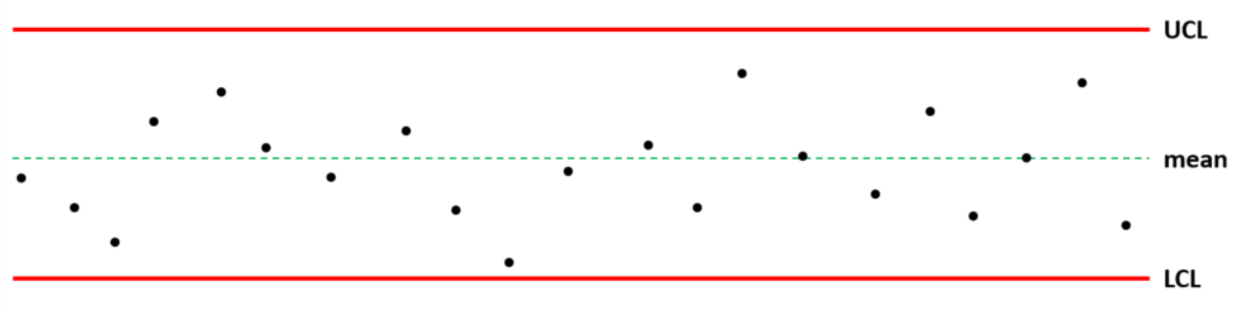
Now remember, much of data science is the science of recognizing when things are behaving as they normally should, and detecting an instance where something is misbehaving. In the context of a control chart, that misbehavior is indicated by a single point or a series of points that are doing what you would not expect them to be doing under normal circumstances. You will now go over some of the rules that indicate misbehavior.

These are not all of the rules, but these are the most common. Sometimes, some of these rules are slightly different, but similar to what is listed.

# Collecting Data

Now, all you need to do is collect data. No matter what the process is, there should be some method determined for randomly selecting and measuring on a continual basis. You might be measuring a single item per lot, or you might be measuring the total sales in a month. Whatever your measuring plan is, the most important part is consistency.

As each data point is collected, it is plotted on the control chart. Typically, the older points are to the left, and the newer points are to the right. If your process runs for a long time and you end up collecting hundreds or even thousands of data points, it is customary to only show the most recent points. Usually an active control chart will show anywhere from 20 to 40 points. After that, as new data scroll onto the chart from the right, old data are allowed to fall off of the left side. The 20 to 40 points part is not a hard-and-fast rule, it is a guideline.




You should also account for how much data is included in terms of elapsed time. For instance, if your process is collecting several data points every minute, you could end up with thousands of data points in a single day. If your control chart only displays 40 points, and you collect 5 data points per minute, the SPC chart will only show what has been happening over the last 8 minutes.

This may not be terribly helpful to an engineer that is trying to use the control chart to monitor a process. If the engineer takes a 45 minute lunch break, and then returns to the chart, several full cycles of data will have scrolled on and off again while they were away. You should let common sense help dictate what you want to see on the control chart. So when collecting data, review the company's process control plan before calculating new control limits.