Major parts of a control chart.

1. Quality scale: This is a vertical line. The scale is marked according to the quality characteristics of each sample.

2. plotted samples: The quality control chart will not contain the qualities of individual items of a sample. only the quality of the entire sample represented by a single value is plotted. The single value plotted in the chart is in the form of a dot.

3. Sample numbers: The samples plotted on a control chart are number individ-ually and consecutively on a horizontal line. Thise is at the bottom of the chart. The samples are referred as sub groups.

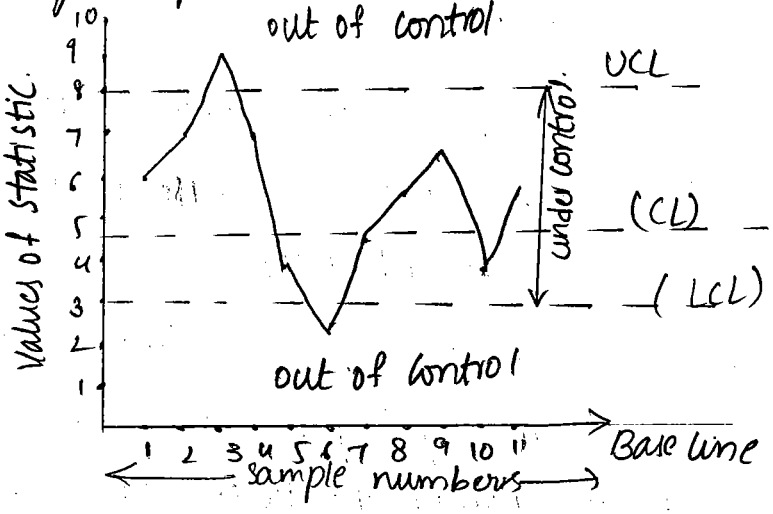
4. Horizontal lines: A control chart has 3 horizontal lines starting from the right hand side of the vertical lines and parallel to the base line of the chart. The vertical line represents the quality statistic of each sample. The base line shows the sample number scale.

The three horizontal lines are called control lines.

1. control line: It passes through the middle of the chart and is parallel to the base line. It represents the prescribed standard quality of the product in the process. If the process is in the perfect state of control and product produced conforms perfectly to the prescribed standard, the sample points will coincide with this line. The central line represents the mean (μ).

2. upper control limit (UCL): It is shown in the chart by a dotted line that passes through the chart above and parallel to the central line and represents the upper limit of tolerance. This line indicates the maximum highest limit of variation in the process that can reasonably be attributed to chance causes. If a sample point falls beyond and outside this limit, It indicates that a variation in the process has occured due to assignable causes. Thus, the process is deemed to be out of control.

3. lower control limit (LCL): It is shown in the chart by a dotted line that passes through the chart below and parallel to the central line. It represents the lower limit of tolerance. This line indicates the maximum lowest limit of variation in the process that can reasonably be attributed to chance causes. If a simple point falls beyond and outside this limit, It indicates that a variation in the process has occured due to assignable ~~problem~~ causes. Thus, The process is deemed to be out of control.



control chart

GAMMA DISTRIBUTION

The continuous random variabe x is said to follow a gamma distribution with parameter 'λ' If it's probability function is given by $f(x) = \begin{cases} \frac{e^{-x}x^{\lambda-1}}{\Gamma(\lambda)}, & \lambda>0, 0<x<\infty \\ 0, & \text{otherwise.} \end{cases}$

Note: A continuous random variable x whose probability function is $f(x) = \frac{\lambda}{\Gamma(r)}(\lambda x)^{r-1}e^{-\lambda x}$, $r>0, \lambda>0, \alpha x<\infty$ is called a Gamma distribution with two parameters, r and λ

WEIBULL DISTRIBUTION: A continuous random variable x having the following probability density function is said to have weibull distribution with parameters α and c

$$f(x) = \frac{\alpha}{c}\cdot x^{\alpha-1}\cdot e^{(x/c)^{\alpha}}; \quad x\geq 0, c>0, \alpha>0$$ where c is the scale parameter and α is the shape parameter.

This distribution was used by swedish scientist weibull in 1951, to describe experimentally observed variation in the fatique resistance of steel, its plastic limits, etc. But it has also been employed to study the variation of length of service of radio service equipment.

Note 1: The continuous random variable x is said to follow weibull distribution with 3 parameters $c>0, \alpha>0$ and μ if its probability function is given by $f(x) = c\alpha^{-1}\left(\frac{x-\mu}{\alpha}\right)^{c-1}\cdot e^{\left(\frac{x-\mu}{\alpha}\right)^{c}}; \quad x\geq\mu, \; c>0$ — (1)

Note 2: By putting $\alpha=1, \mu=0$ in (1), we get the probability density function of standard weibull distribution which depends only on a single parameter c and is given by

$$f(x) = cx^{c-1}e^{-x^{c}}; \quad x>0, c>0$$