CONTROL CHART

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General idea of Control Chart

The development of control charts was made by a young physicist Dr. W.A. Shewhart in 1924. The control charts are the simplest type of statistical process control procedure which may also be used to estimate the parameters of a production process and through this information, determine process capability. These charts are simple to construct and easy to interpret and tell us at a glace whether the sample point falls within the $3 - \sigma$ control limits or not. Any sample point going outside the $3 - \sigma$ control limits is an indication of the lack of statistical control , i.e., presence of assignable causes of variation which must be eliminated.

A typical control chart consists of the following three horizontal lines:

- A Central line
- Upper Control line
- Lower Control line.

These control limits are chosen so that if the process is in control all of the sample points will fall between them. As long was the points plot within the control limits, the process is assumed to be in contral and no action is necessary. However, a point that plots outside of the control limits is interpreted as evidence that the process is out of control and investigation and corrective action is required to find and eliminate the assignable cause of variation. In the control chart, upper and lower control limits are usually plotted as dotted lines and central line is plotted as a dark line.

If t is the statistic, then their values depend on the sampling distribution of t are given by,

$$UCL = E(t) + 3\ S.E.(t)$$

$$LCL = E(t) - 3\ S.E.(t)$$

3 – σ control limits

3 – σ limits were proposed by Dr. Shewhart. Let us consider the statistic $t\ (x_1, x_2, \ldots, x_n)$, a function of the sample observations and let $E(t) = \mu$ and $V(t) = \sigma^2$

If t is normally distributed then from the area property of normal distribution we have,

$$P[\mu - 3\sigma \le t \le \mu + 3\sigma] = .9973$$

Which gives $P[|t - \mu| \le 3\sigma] = .9973$, or

$$P[|t - \mu| > 3\sigma] = .0027$$

Thus, the probability that a random value of *t* goes outside the $3 - \sigma$ limits is 0.0027. Hence if *t* is normally distributed, then the limits of variation should be between $\mu+3\sigma$ and $\mu-3\sigma$ which are termed as UCL and LCL respectively.