

Selecting Control Charts

Process Measurements are available

Diameters, length, thickness, pressures, temperatures, concentration, analyticals, etc.

Control Charts for Variables

Non homogeneous output
Non expensive measurement

Homogeneous output
Expensive measurement

Sample size ≤ 5

Sample size ≥ 5

Sample size = 1

X - R Charts

Median Charts

X - s Charts

Charts for Individuals

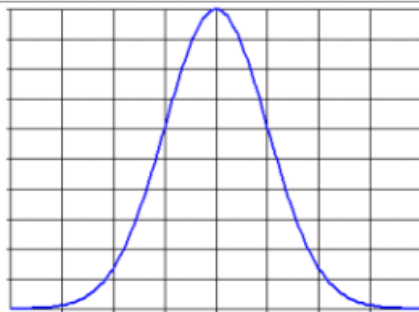
Simple to calculate
Most commonly used

Simple to calculate
Shows spread of the process
Good to compare several processes

Complex to calculate
More efficient indicator
Less sensitive detecting special causes

Simple to calculate
Broadly used for chemical and other homogeneous continuous processes

Normal distribution curve



Z =	2.500	$y = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$
Cumulative probability $x \leq 2.5$	0.9938	
Cumulative probability $x > 2.5$	0.0062	

Process Measurements are not available

Good/bad, defective/non defective unit, number of defects, pass/fail, present/absent, etc.

Control Charts for Attributes

Non conforming units
Number of defective pieces

Non conformities
Counting of defects

Constant sample size

Sample size can be variable

Constant sample size

Sample size can be variable

np - Charts

p - Charts

c - Charts

u - Charts

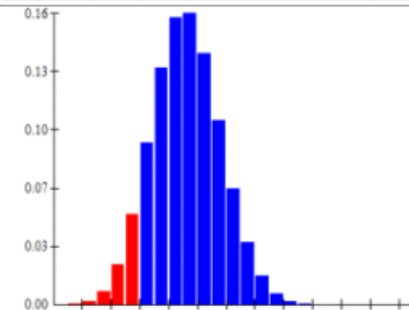
Number of defective

Proportion (%)
Variable control limits
Use np Chart if sample size is constant

Number of defects

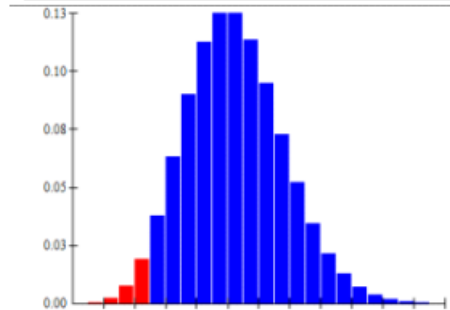
Proportion (%)

Binomial distribution



Probability P(5)	0.05058	$P(x) = \binom{n}{x} p^x q^{n-x}$
Cumulative probability $x \leq 5$	0.08262	
Cumulative probability $x > 5$	0.91738	

Poisson distribution



Probability P(4)	0.01892	$P(x) = \frac{e^{-\lambda} \lambda^x}{x!}$
Cumulative probability $x \leq 4$	0.02925	
Cumulative probability $x > 4$	0.97075	