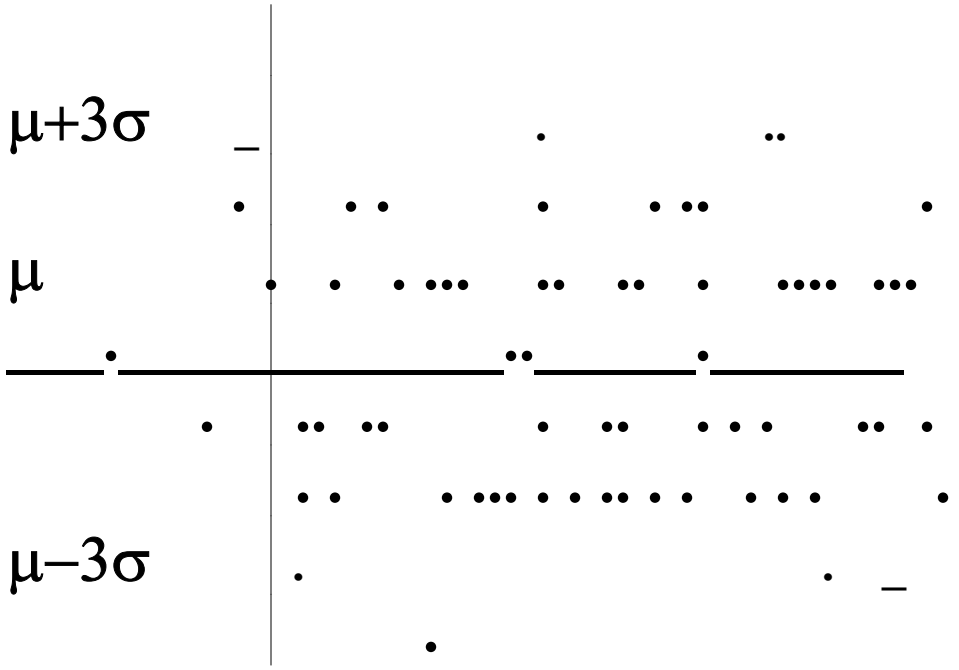
PROCESS CAPABILITY

GIVEN: A VARIABLE TO BE TRACKED, For example, the diameter of a machined part:

Let T=Target Diameter
USL= Upper Specification Limit
LSL= Lower Specification Limit

Collect some data for the diameters, X1, ..., Xn

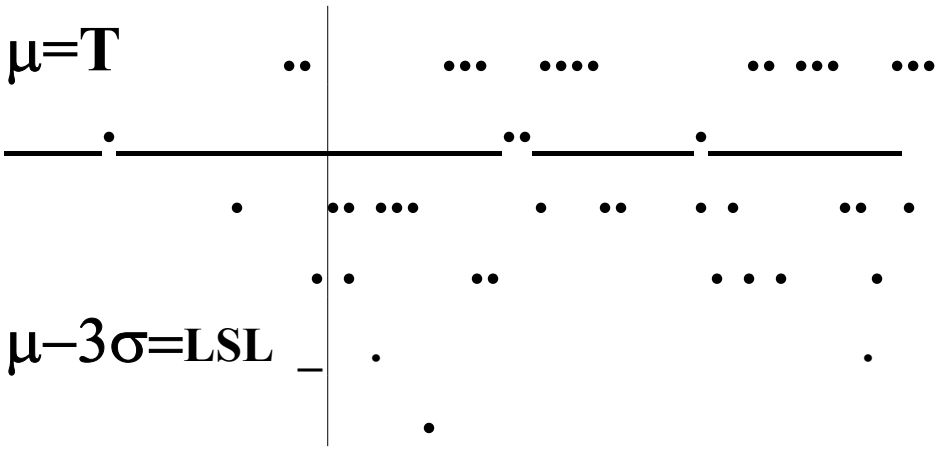
Suppose $\mu=\Sigma X_i/n$, $\sigma= \Sigma(X_i-\mu)^2/n-1$.



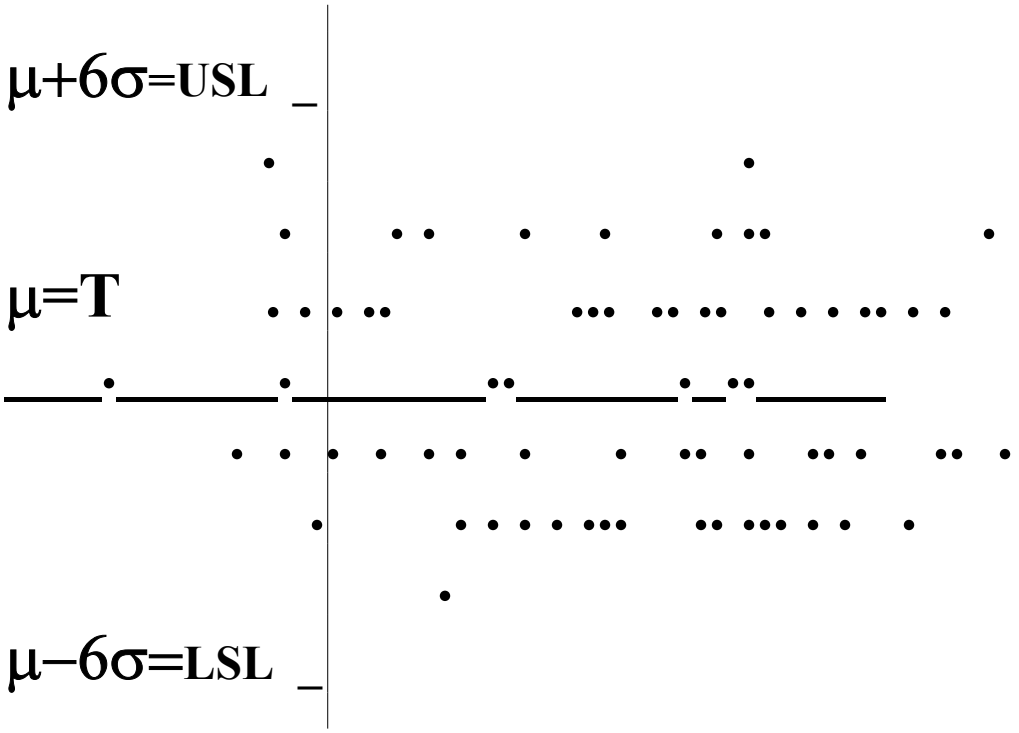
How well is the process performing?

One Measure: Cp=(USL-LSL)/6σ

If $\mu=T$, $\mu+3\sigma$**=USL, and** $\mu-3\sigma$**=LSL, then, Cp=1.**



If μ=T, μ+6σ=USL, and μ−6σ=LSL, then, Cp=2.



Which is better, Cp=1 or Cp=2?

Define Cpk=min{(USL-μ)/3σ, (μ–LSL)/3σ}
Suppose T+3σ=USL and T–3σ=LSL.
If μ=T, then Cp=Cpk
If μ>T, e.g., if μ=T+σ, then

Cp=(T+3σ-T–3σ)/6σ=1

Cpk=min{(T+3σ-T–σ)/3σ, (T+σ–T+3σ)/3σ}
=min{2/3, 4/3}=2/3.

Which measure do you prefer?

At Motorola, *6σ program* aims for Cpk=2 for all processes. What defect frequency does that imply? (Hint: Z~N(0,1)=6 =>area under curve=.4999983.)