PROBLEM SET 6

Problems on Process Capability Indices and Lead Time Analysis of Supply Chains

Instructions:

1. *In all the problems assume that the process is Normal with mean μ and standard deviation σ and also the target value τ is midpoint of upper specification limit (USL) and lower specification limit (LSL).*

2. *Stick to the standard notation discussed in the class.*

Q1. Construct an example of two processes X_1 and X_2 such that:
(A)Both the processes have same value of index C_p but different value of index C_{p_k}.

(B)Both the processes have same value of index C_{p_k} but different value of index C_p.

The example in both the cases must consist of numerical values of μ, σ, τ, T for both the processes. In each case, out of X_1 and X_2 which one is better process and why?

Q2. (A) Derive a condition in terms of parameters σ, p, and T for which index C_p and C_{p_k} of two processes X_1 and X_2 are equal.

(B) Is it possible to construct an example of two processes X_1 and X_2 such that both the processes have same value for both the indices C_p and C_{p_k} but have different value for index C_{p_m}. Give proper justification.

(C) Can you think of some quantity other than C_{p_m} which can be used to construct such an example.

Q3. A study of previous records of a logistic facility has shown that it takes 2.5 days on an average to ship the goods from Bangalore to Chennai. If customer wants the goods to be shipped within 1 day to 3 days then the Deliver Sharpness (DS) offered by the facility is $\frac{1}{3}$. Using all the standard assumptions for logistic process find out:

(A) $C_p, C_{p_k}, \sigma, \mu, \tau, s, p, T$.

(B) Actual yield, upper bound, lower bound and potential of the logistic process. Also explain what are the various delivery probabilities which are represented by these quantities.

(C) Delivery Probability (DP) level (in terms of σ level).

Table 1: Known Parameters for Plastic Industry Supply Chain Problem

Procurement (X_1)	Sheet Fabrication (X_2)	Inbound Logistics (X_3)	Manufacturing (X_4)	Assembly (X_5)	Outbound Logistics (X_6)
$\mu_1 = 7$ days	$\mu_2 = 30$ days	$\mu_3 = 3$ days	$\mu_4 = 30$ days	$\mu_5 = 10$ days	$\mu_6 = 3$ days
$\tau_1 = 6.5$ days	$\tau_2 = 28$ days	$\tau_3 = 3$ days	$\tau_4 = 28$ days	$\tau_5 = 9$ days	$\tau_6 = 2.5$ days
$T_1 = 1$ days	$T_2 = 3$ days	$T_3 = 1$ days	$T_4 = 3$ days	$T_5 = 2$ days	$T_6 = 1$ days
$\sigma_1 = 0.25$ days	$\sigma_2 = 1$ day	$\sigma_3 = \frac{1}{6}$ day	$\sigma_4 = 1$ day	$\sigma_5 = 0.5$ day	$\sigma_6 = 0.2$ day

Q4. Consider the six stage linear supply chain for a plastic industry:

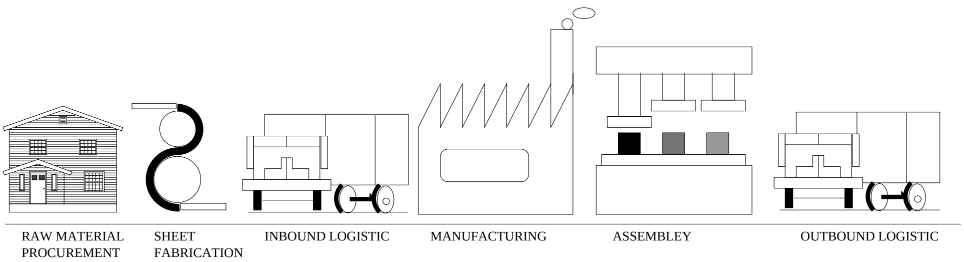

Figure 1: A Typical Plastic Industry Supply Chain

Let all the business processes in the chain satisfy all the necessary assumptions made for analysis model. The problem here is to find out delivery probability and delivery sharpness for end-to-end supply chain lead time Y, and end-to-end lead time of all the processes X_i. The known parameters are listed in Table 1. Assume the target value τ and tolerance T of the supply chain lead time Y is 82 days and 6.5 days respectively.