DSES 4230

Quality Control

Spring 06

Test II

Excellent as usual

Name:

Test Score: 60 /60

Total Score: 98/100

Test Rank: 1 /32

Class Rank: 3 /32

Great job!

03/30/06

Problem 1 15 points

a) Are rational subgroups also random samples? Explain why or why not. (3)

No, because you are determining how to take them (consecutively or distributed) which takes the random out of it, and incurs bias

b) There is a tendency for some to mistrust the 'out of control' signals and wait for another point or two to go out of control before taking any action. What do you think about such an approach? Discuss. (3)

The longer you wait to take any action, the longer your process is out of control, meaning your company is losing money. The control chart will not lie to you, there is no need to wait for more points out of control.

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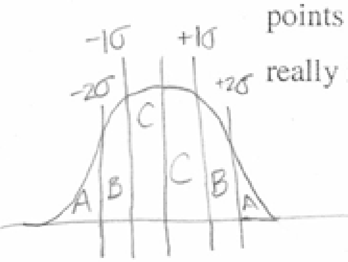
c) One of the tests used to detect an out of control signal is, "15 or more successive points fall in Zone C". Find the probability of that event occurring if the process is really in control. (6)



$\mu = 0 \quad \sigma = 1$

$P(x < 1) - P(x < -1)$

$\frac{1-0}{1} = 1 \qquad \frac{-1-0}{1} = -1$

$z_1 = .8413 \qquad z_{-1} = .1587$

$.8413 - .1587 = .6826 \rightarrow$ P(1 point falls in zone C)

$.6826^{15} = \boxed{.00325} \rightarrow$ P(15 points fall in zone C)

d) For a stable process, why don't we want all the points on the X-bar chart to be on or close to the centerline? What might be the reason for such pattern? (3)

Because the data is suppose to be normal, and not all points should be in the center, they should be distributed accordingly. Stratification, or the output of several machines grouped into a single sample, will cause such a pattern.

Problem 2 15 points

a) For a certain process X-bar and R charts based on subgroups of size 5 have centerlines 14.5 and 1.163, respectively. Given that the process has specification limits of 12 and 16, calculate C_p, C_{pl}, C_{pu}, and C_{pk}.

$\bar{\bar{X}} = 14.5 \quad \bar{R} = 1.163 \quad USL = 16 \quad LSL = 12 \quad n = 5$

$\hat{\sigma}_x = \bar{R}/d_2 = 1.163/2.326 = .5$

$C_p = \frac{USL - LSL}{6\sigma} = \frac{16-12}{6(.5)} = 4/3 = \boxed{1.33}$

$C_{pl} = \frac{\mu - LSL}{3\sigma} = \frac{14.5-12}{3(.5)} = 2.5/1.5 = \boxed{1.67}$

$C_{pu} = \frac{USL - \mu}{3\sigma} = \frac{16-14.5}{3(.5)} = 1.5/1.5 = \boxed{1}$

$C_{pk} = \min(C_{pu}, C_{pl}) = \boxed{1}$

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b) Three parts are assembled in series. The dimensions of each part are normally distributed with the following parameters: $\mu_1 = 200$, $\sigma_1 = 6$, $\mu_2 = 150$, $\sigma_2 = 2$, and $\mu_3 = 150$, $\sigma_3 = 3$. What is the probability that an assembly chosen at random will have a combined dimension in excess of 509?

$\mu_1 = 200$	$\mu_2 = 150$	$\mu_3 = 150$
$\sigma_1 = 6$	$\sigma_2 = 2$	$\sigma_3 = 3$

$\mu = 500$

$\sigma = \sqrt{\sigma_1^2 + \sigma_2^2 + \sigma_3^2} = \sqrt{36+4+9} = 7$

$P(X \leq 509) \rightarrow z = \frac{x-\mu}{\sigma} = \frac{509-500}{7} = 1.2857 \rightarrow \sim .9006$

$P(X > 509) = 1 - P(X \leq 509) = 1 - .9006 = \boxed{.0994}$

Problem 3 30 points

The following values were computed for samples of size 6. Compute the trial UCL, CL, and LCL for both X-bar and R charts (Do not plot). If any out of control points, assume assignable causes and calculate revised limits and center lines. outside limits

SAMPLE	X-BAR	R	SAMPLE	X-BAR	R
1	20.35	.34	14	20.41	.36
2	20.40	.36	15	20.45	.34
3	20.36	.32	16	20.34	.36
4	20.65 X	.36	17	20.36	.37
5	20.20 X	.36	18	20.42	.37
6	20.40	.35	19	20.50	.38
7	20.43	.31	20	21.31 X	.35
8	20.37	.34	21	20.39	.33
9	20.48	.30	22	20.39	.33
10	20.42	.37	23	20.40	.32
11	20.39	.29	24	20.41	.34
12	20.38	.30	25	20.40	.30
13	20.40	.33	Σ	511.01	8.48

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$\bar{\bar{X}} = 20.44$ $\bar{R} = .339$

$UCL_{\bar{x}} = \bar{\bar{X}} + A_2\bar{R} = 20.44 + .483(.339) = \underline{20.604}$

$CL_{\bar{x}} = \underline{20.44}$

$LCL_{\bar{x}} = \bar{\bar{X}} - A_2\bar{R} = 20.44 - .483(.339) = \underline{20.276}$

$UCL_R = D_4\bar{R} = 2.004(.339) = \underline{.679}$

$CL_R = \underline{.339}$

$LCL_R = D_4\bar{R} = \underline{0}$

$\boxed{\text{new}}$ $\bar{\bar{X}} = \frac{\Sigma \bar{X}}{K} = \frac{448.85}{22} = 20.402$

$\bar{R} = \frac{\Sigma R}{K} = \frac{7.41}{22} = .337$

$UCL_{\bar{x}} = 20.565$

$CL_{\bar{x}} = 20.402$

$LCL_{\bar{x}} = 20.239$

$UCL_R = .675$

$CL_R = .337$

$LCL_R = 0$