HW # 7: Due Tues 10/22 by 11:59pm ET

Graded

11 Minutes Late

Student

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Total Points

10.75 / 15 pts

Question 1

Problem 1

8.25 / 10 pts

✔ **– 0.75 pts** part (d): the mean is not necessarily the midpoint of the specification interval. Since the mean is not known in this problem, should use $\widehat{\mu} = \overline{\overline{x}}$

✔ **– 1 pt** parts (a)-(b): something is off on your charts, as there are only 20 samples yet your horizontal axis extends to sample 81.

Question 2

Problem 2

2.5 / 5 pts

✔ **– 2.5 pts** part (a): not exactly clear what you're attempting here. You're sort of treating the control limits as if they were values of a normal random variable and are "standardizing" them. The idea here is to use the control limits to determine L, and then use L to determine α.

Question assigned to the following page: 1

Problem 1.Suppose 20 random samples of size n = 5 were collected from some normally distributed process. The data is contained in columns G through K in the `hw_data.xlsx` file. The process mean μ and the process standard deviation σ are assumed to be unknown.

(a) Use the appropriate formulas to compute the center line and the 3 -sigma control limits for an R-chart. Then use Minitab to create this control chart (include the chart, and make sure your computed limits agree with Minitab's).

(a) $UCL = D_4 \cdot \bar{R}$

$CL = \bar{R}$

$LCL = D_3 \cdot \bar{R}$

$$\boxed{D_3 = 1 - 3 \cdot \frac{d_3}{d_2}, \quad D_4 = 1 + 3 \cdot \frac{d_3}{d_2}}$$

$\bar{R} = \frac{\sum_{i=1}^{k} R_i}{k}$, $k = 20$

$\bar{R} = 40.71$

$UCL = 2.114 \cdot 40.71 = 86.06094$

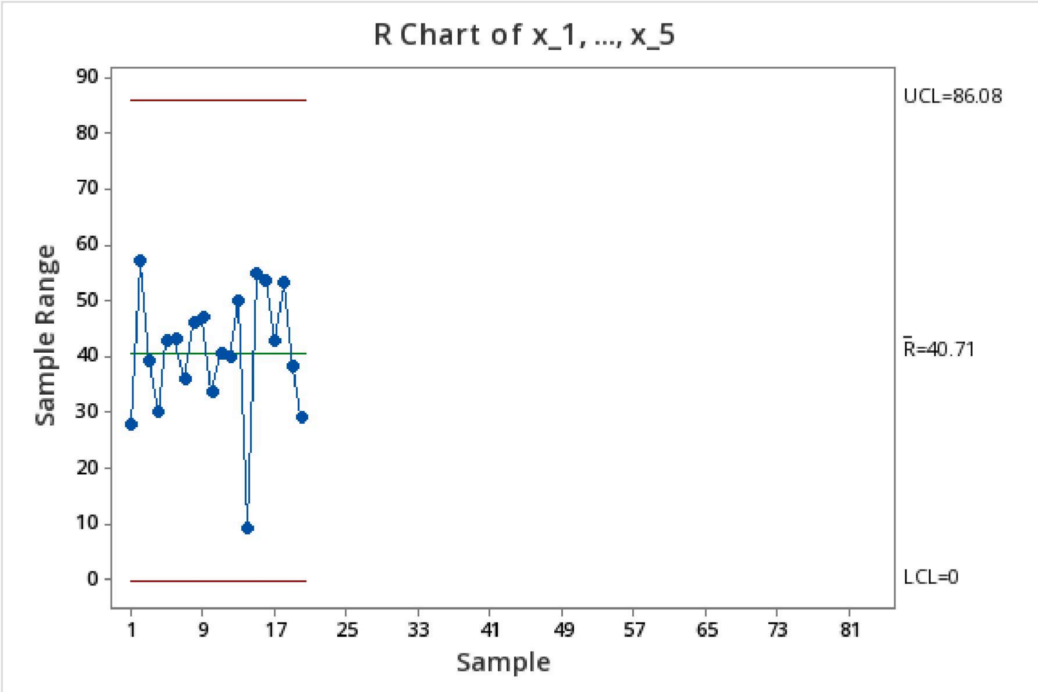
$CL = 40.71$

$D_3 = 0$

$LCL = 0 \cdot 40.71 = 0$

$D_4 = 2.114$

Question assigned to the following page: 1



(b) Use the appropriate formulas to compute the center line and the 3-sigma control limits for an s-chart. Then use Minitab to create this control chart (include the chart, and make sure your computed limits agree with Minitab's).

Question assigned to the following page: 1

D) $UCL = B_4 \cdot \bar{S}$

$CL = \bar{S}$

$LCL = B_3 \cdot \bar{S}$

$B_4 = 2.089$ $\quad \bar{S} = 16.6345$

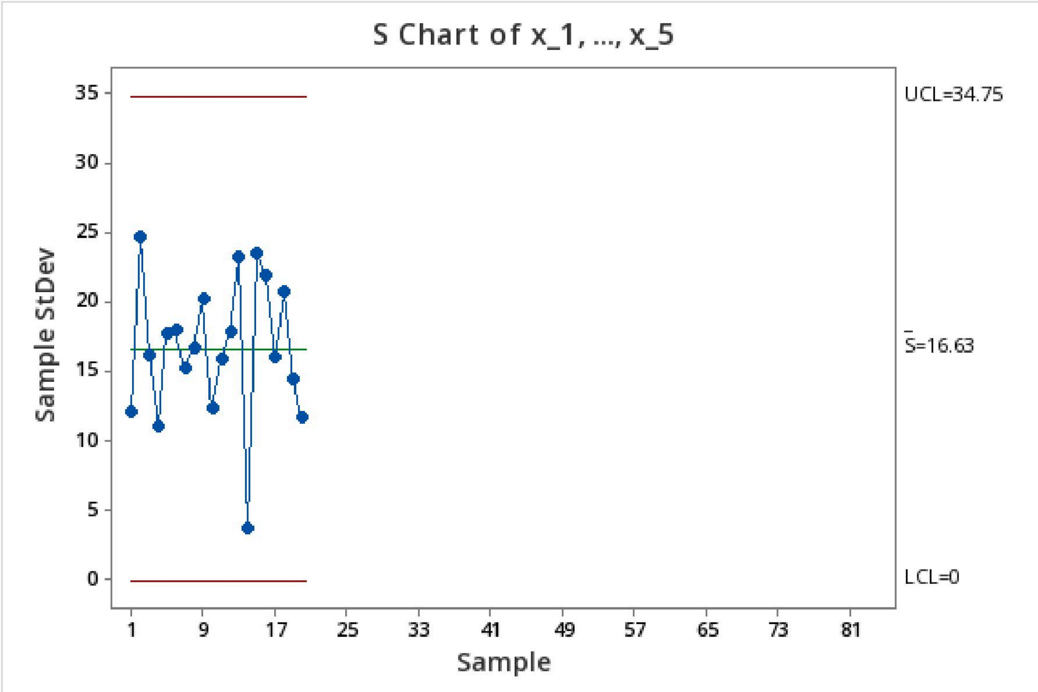
$B_3 = 0$

$UCL = 2.089 \cdot 16.6345 = 34.7494705$

$CL = 16.6345$

$LCL = 0$

Question assigned to the following page: 1



(c) Estimate the process standard deviation using the s-bar method. Use this estimate in part(d) below.

(c) $\hat{\sigma} = \dfrac{\bar{S}}{c_4}$

$$\hat{\sigma} = \frac{16.6345}{0.9400} = 17.6962765975$$

(d) Determine the proportion of items expected to meet specifications if the specification limits are 129 ± 25.

Question assigned to the following page: 1

(d) 129 ± 25

$LSL = 129 - 25 = 104$

$USL = 129 + 25 = 154$

$\hat{\sigma} = 17.6962765975$

$$Z_{USL} = \frac{154 - 129}{17.6962765975} = 1.41272656213$$

$$Z_{LSL} = \frac{104 - 129}{17.6962765975} = -1.41272656213$$

$$P(104 < X < 154) = P(Z_{USL}) - P(Z_{LSL})$$

$$= 0.9207 - 0.0793$$

$$\Rightarrow 0.8414$$

$$P(Z < 1.41) = 0.9207$$

$$P(Z < -1.41) = 0.0793$$

Question assigned to the following page: 2

Problem 2. A quality control engineer produced an R-chart for a production process and obtained the following control limits:

R−chart LCL = 2.015, CL = 8, UCL = 13.985

The sample size is n = 10, the chart indicates the process is in-control, and the process is assumed to be normally distributed.

(a) What is the α-risk (i.e., level of significance) associated with the R-chart?

Question assigned to the following page: 2

(a) $LCL = 2.015$

$CL = 8$

$UCL = 13.985$

$\bar{R} = 8$

$D_3 = 0.223$

$\sigma = \frac{8}{5.469}$

$D_4 = 1.777$

$= 1.46279027244$

$$Z_{LCL} = \frac{2.015 - 8}{1.46279027244} = -4.09$$

$$Z_{UCL} = \frac{13.985 - 8}{1.46279027244} = 4.09$$

$$\alpha = \underset{0}{P(x < -4.09)} + \underset{0}{P(x > 4.09)}$$

$\alpha = 0$

Question assigned to the following page: 2

(b) Based on the control chart in use, provide an appropriate estimate of the process standard deviation.

(b) $\hat{\sigma} = \dfrac{\bar{R}}{d_2}$ $\qquad d_2 = 3.078$

$$\hat{\sigma} = \frac{8}{3.078} = 2{,}59909031839$$