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QUALITY CONTROL OF SERA, BY USING DIFFERENT CHARTS

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ABSTRACT

Quality control of sera by using $\overline{X}$ *chart, C – Chart, R – Charts for testing of sample.*

Keywords: *Sera, Mean Chart, Defective Chart, Range Chart.*

INTRODUCTION

I. $\overline{X}$ CHART

The $\overline{X}$ chart is used to show the quality averages of the samples drawn from a given process. The following values must first be computed before an $\overline{X}$ chart is constructed:

1. Obtain the mean of each sample, i.e, $\overline{X}_1, \overline{X}_2, \overline{X}_3$ etc. This is done by dividing the sum of the values included in a sample $\left(\sum X\right)$ by the number of items in the sample (n or sample size).

$$\overline{\overline{\mathrm{x}}} = \frac{\sum \overline{X}}{n}$$

2. Obtain the mean of the sample means, i.e., $\overline{\overline{X}}$ This is done by the sum of the sample means $\left(\Sigma \overline{X}\right)$ by the number of samples to be included in the chart.

$$\overline{\overline{X}} = \frac{\Sigma \overline{X}}{Number\ of\ samples}$$

3. The control limits are set at

U.C.L. = $\overline{\overline{X}} + 3\sigma \overline{X}$

L.C.L. = $\overline{X} - 3\sigma \overline{X}$

where $\sigma_x = \frac{\sigma}{\sqrt{n}}$ and $\sigma = d'\overline{R}$

$\overline{R}$ is a biased estimator of σ and d' is the correction factor. Therefore the control limits are.

U.C.L. = $\overline{\overline{X}} + A_2\overline{R}$

L.C.L. = $\overline{\overline{X}} - A_2\overline{R}$

II. C – CHART

The C – Chart is designed to control the number of defects per unit. It is very popularly used in statistical work. The central line of the control chart for C is $\overline{C}$ and the 3- sigma control limits are:

U.C.L. = $\overline{C} + 3\sqrt{\overline{C}}$

L.C.L. = $\overline{C} - 3\sqrt{\overline{C}}$

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III. R –CHART

The R – chart is used to show the variability or dispersion of the quantity produced by a given process. R chart (or σ chart) is the companion chart to $\overline{X}$ chart and both are usually required for adequate analysis of the production process under study. The R chart is generally presented along with the $\overline{X}$ chart. The general procedure for constructing the R chart is similar to that for the $\overline{X}$ chart. The required values for constructing the R chart are:

1. The range of each sample. R
2. The mean of the sample ranges. $\overline{R}$
3. U.C.L. and L.C.L.

   U.C.L.$_R$ = $\overline{R}+3\sigma_R$; and

   L.C.L.$_R$= $\overline{R}-3\sigma_R$

   where σ_R = the standard error of the range

Chart – 1 ($\overline{X}$ - Chart**)**

1. **Specimen analyzed:** Quality control serum
2. **Determination:** Glucose by glucose oxidase method
3. **Mean glucose value:** 100 mg/dl.

Table: 1

Date	**Sample –I Individual test values**	**Date**	**Sample –II Individual test values**	**Date**	**Sample - III Individual test values**	**Sample mean** $\overline{X}$	**Sample Range R**
12.2.12	95	18.2.12	98	23.2.12	96	96.3	3
13.2.12	98	19.2.12	101	24.2.12	100	99.6	3
14.2.12	100	20.2.12	104	25.2.12	102	102	4
15.2.12	97	21.2.12	97	26.2.12	98	97.3	1
16.2.12	106	21.2.12	106	26.2.12	108	106.6	2
17.2.12	110	22.2.12	100	27.2.12	105	105	10

i. $$\overline{X}=\frac{\Sigma\overline{X}}{n}$$

ii. $$\overline{\overline{X}}=\frac{\Sigma\overline{X}}{Number\ of\ samples}$$

iii. The control limits are set at

U.C.L. = $\overline{\overline{X}}+3\sigma\overline{X}$

L.C.L. = $\overline{\overline{X}}-3\sigma\overline{X}$

where

$$\sigma_x=\frac{\sigma}{\sqrt{n}} \text{ and } \sigma=d'\overline{R}$$

$\overline{R}$ is abased estimator of σ and d' is the correction factor. The values of d' are tabulated and are tabulated and are given in the appendix at the end of the book.

U.C.L= $\overline{\overline{X}}+A_2\overline{R}$

L.CL= $\overline{\overline{X}}-A_2\overline{R}$

1. The mean of each sample $\overline{X}$ is given in the table for example $\overline{X}$ for the first sample is $\frac{289}{3}=96.33$

2. The mean of the sample means $\overline{\overline{X}}$ is obtained that $\overline{\overline{X}} = \frac{\sum \overline{X}}{6} = \frac{606.8}{6} = 101.13$

3. The value of $\overline{R}$ is computed from the values of R shown in the table 1. The sample value of R for the first sample is computed as follows.
   $R = 98 - 95 = 3$

4. The value or $\overline{R}$,i.e. the mean of the values of R is obtained as follows:
   $\overline{R} = \frac{\sum R}{6} = \frac{23}{6} = 3.83$

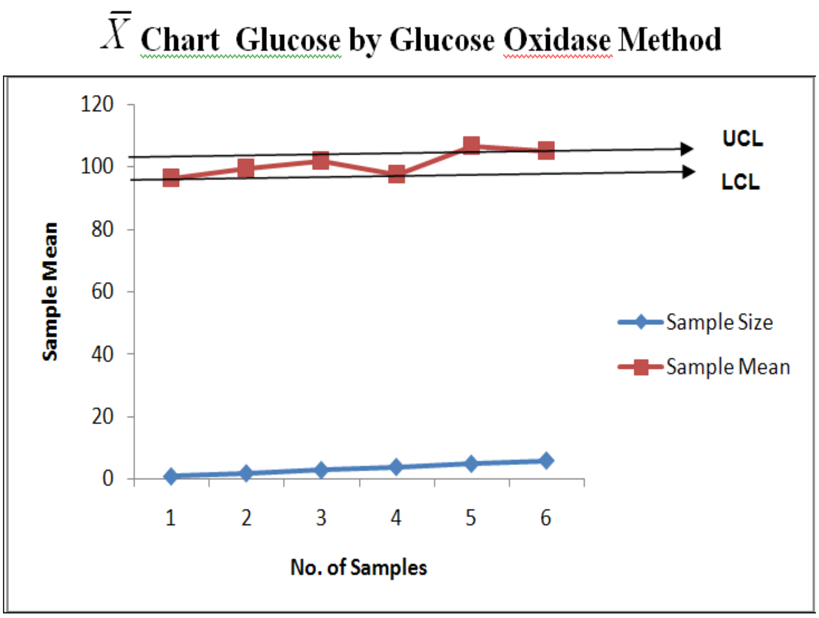
5. 5.U.C.L $= \overline{\overline{X}} + A_2\overline{R}$

[The table value of A_2 for n=6 is 0.483]

$$\therefore U.C.L = \overline{\overline{X}} + A_2\overline{R}$$
$$= 101.13 + 0.483 \times 3.83$$
$$= 101.13 + 1.849$$
$$= 102.97 \text{ mg/dl app}$$

L.C.L $= \overline{\overline{X}} - A_2\overline{R}$
$$= 101.13 - 0.483 \times 3.83$$
$$= 101.13 - 1.849$$
$$= 99.281 \text{ mg/dl app}$$

Drawing a chart:



All the points except to points are not falling with in the control Limits. The process is not in a state of control

R –chart

The required values for the R chart are:
1. The range of each sample, R
2. The mean of the sample ranges R

$$\overline{R} = \frac{\sum R}{6} = \frac{23}{6} = 3.83$$

U.C.L R= $D_4\overline{R}$

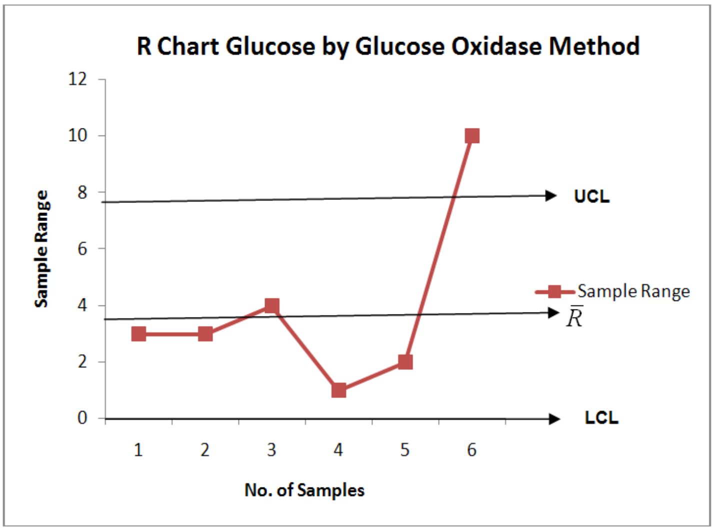
$$L.C.L_R = D_3\overline{R}$$

From the table for the sample of size 6, we find that

$$D_3 = 0, D_4 = 2.004$$

$$\therefore U.C.L = D_4\overline{R} = 2.004 \times 3.83$$
$$= 7.67$$

$$L.C.L = D_3\overline{R} = 0 \times 3.83$$
$$= 0$$



CONCLUSION

The fact that in the graph all sample points are falling except one point with in 3σ control limits can be interpreted as implying that the process is in a state of statistical control.

CHART – 2 (C – Chart)

The following table gives the number of errors of alignment observed at final inspection of a In order to check the accuracy of the analysis run and also the quantity control sera, detect systematic errors, when a systematic error (all low values or all high values) is present the cusum values will steadily increase.

Table - 2

Date	Mean Value	Individual test values	Defectives
12.2.12	100	98	+2
13.2.12	100	101	-1
14.2.12	100	96	+4
15.2.12	100	97	+3
16.2.12	100	106	-6
17.2.12	100	106	-6
18.2.12	100	96	4
19.2.12	100	102	-2
20.2.12	100	100	0

21.2.12	100	97	3
22.2.12	100	98	2
23.2.12	100	95	+5
24.2.12	100	103	-3
25.2.12	100	97	3

U.C.L. = $\bar{C}+3\sqrt{\bar{C}}$

L.C.L. = $\bar{C}-3\sqrt{\bar{C}}$

$\bar{C}$ CHART:

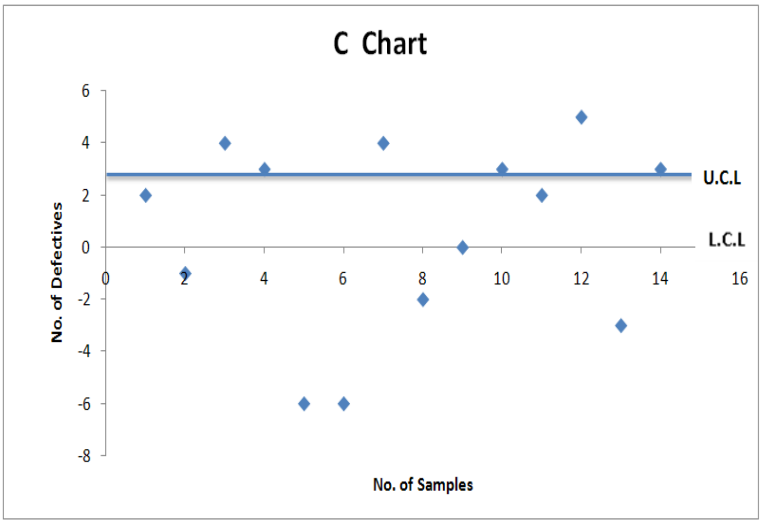
The computation required for preparing this chart

(i) $\bar{C}$, i.e average number of defects

$$\bar{C}=\frac{8}{14}=0.57$$

U.C.L. = $\bar{C}+3\sqrt{\bar{c}}$
= 0.57+3x0.75
= 0.57+2.26
= 2.83

L.C.L = $\bar{C}-3\sqrt{\bar{c}}$
= 0.57-3x0.75
= 0.57-2.26
= -1.69 or 0 (zero) since L.C.L cannot be negative.



CONCLUSION

It is clear from the chart that most of the point of this sample falls outside the control limits and this is to be treated as a danger signal.

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