Unit-5 Statistical Quality Control

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1. Define statistical quality control?

Statistical quality control is an application of statistical techniques to measure and inspect the quality of a product, service or process.

2. Explain the method of applying statistical quality control.

It is the procedure for control of quality using the application of theory of probability to the results of inspection of samples of the population.

3. What is variation and what are the two types of variations in SQC?

Variation in the quality of the product while manufacturing is inherent and inevitable. But this variability is the enemy of quality. There are two types' variations:

Chance cause/Random variation /Common variation /Inherent variation: The variation beyond the control of human hand and can't be prevented.

Assignable cause/Non Random variation /Preventable variation /Special variation: The variation which can be detected and eliminated.

4. Define process control.

It is a concerned with the control of the quality of the product when they are in the process of production.

5. Define product control.

A purchaser may use sampling inspection to test the quality of a shipment of goods received or a producer may submit his own output to acceptance sampling at various stages of production. The purpose of acceptance sampling is to determine whether to accept or reject the product. The whole procedure is called product control.

6. What is control chart ? Write its general structure.

A control chart is a two dimensional graphical display of a quality characteristic that has been measured in terms of mean Or other statistics from sample and plotted against sample number Or time at which the sample is taken from process.

A control chart consists of three horizontal lines, namely

(1)Centre Line (CL), (2) Upper control line(UCL) (3) Lower control line(LCL)

7. Explain Central line ,upper control limit and lower control limits in quality control

- UCL- it represents the upper value of variation in quality characteristic
- LCL-it represent lower value of variation in quality characteristic
- Central line- CL- it represent average level of the process.

8. What are the different types of control charts?

There are two types of control charts.

Control chart for variables	Control chart for attributes
$\bar{X}$ Chart, R Chart and σ Chart.	p-chart, np chart, c chart

9. What do you mean by "process in control " and "process out of control " .

When points on a control chart move outside the upper or lower control limit, the process is said to be "out of control." As long as the points are within control limits, the process is "in control."

10. What is the statistical basis for $\bar{X}$ chart and R chart?

Normal distribution is the statistical basis for $\bar{X}$ chart and R chart

11. Write the advantages of control chart.

(i) It helps to rectify the faults and errors during the process or after the process is over.
(ii) It gives the clue for management for remedial measures.
(iii) It is a tool for predicting the future trend of the production output.

12. Find the lower and upper control limits for $\bar{X}$ chart and R chart , when each sample is of the size 4 and $\bar{\bar{X}}$=10.8 and $\bar{R}$ =0.46 .

Given that, $\bar{\bar{X}}$=10.8 $\bar{R}$=0.46 A_2 = 0.729 D_4 = 2.282 D_3=0

$\bar{x}$ chart	$\bar{R}$ chart
UCL = $\bar{\bar{X}} + A_2\bar{R}$ = 10.8 + 0.729(0.46) = 11.135	$D_4\bar{R}$ = 2.282(0.46) =1.05
LCL = $\bar{\bar{X}} + A_2\bar{R}$ = 10.8 – 0.729(0.46) = 10.465	$D_3\bar{R}$ =0

13. Write down the formulae for UCL and LCL for np- chart

UCL is $n\bar{p} + 3\sqrt{n\bar{p}(1-\bar{p})}$	CL is $n\bar{p}$	LCL is $n\bar{p} - 3\sqrt{n\bar{p}(1-\bar{p})}$

14. Compare c-chart with p-chart

p-chart	c-chart
It is used to record the proportion of defective units in a sample	It is used to record the number of defects in a sample.
It monitor the proportion of faults in a continuous data sample.	It monitor "count"-type data, typically total number of nonconformities per unit.
It follows **binomial distribution.**	It follows **poisson distribution.**
Control limits are $[n\bar{p} \pm 3\sqrt{n\bar{p}(1-\bar{p})}]$	Control limits are $[\bar{c} \pm 3\sqrt{\bar{c}}\,]$

15. A garments was sampled on 10 consecutive hours of population. The number of defects found per garments is given that Defects : 5,1,7,0,2,3,4,0,3,2. Compute upper and lower control limits for monitoring number of defects.

WKT $\bar{c}$ =($\sum c$)/n = 27/10 = 2.7

UCL = 2.7+3√2.7 = 7.63	CL= 2.7	LCL = 2.7 - 3√2.7 = - 2.23 = 0

16. Define tolerance limit

Tolerance limits define the range of data that fall within a specified percentage with a specified level of confidence. In the $\bar{X}$ chart and R-chart the tolerance limits are $\bar{\bar{X}} \pm 3\bar{R}/d_2$

17. Define two-sided tolerance limits

An interval can be called a two-sided tolerance interval if it is of the form (1 – α, P). For example, if α = 0.10 and P = 0.85, then the resulting interval is called a two-sided (90% , 0.85) tolerance interval. If L = –∞ and U < +∞, then the interval (-∞, U] is called a one-sided (1 – α, P) upper tolerance bound.

18. Acceptable Quality Level (AQL)

If 'α' is the producer's risk, then the level of quality which results in 100 (1-α)% acceptance of the good lots submitted for inspection is called the Acceptable Quality Level.

19. What are three types of acceptance plan?

(i) Single sampling plan (ii) Double sampling plan (iii) Multiple sampling plan

20. What is Operating Characteristic Curve (OC curve)

An OC-curve is a curve constructed for examining the acceptance sampling system. In sampling inspection plan, it shows the ability of the plan to distinguish between good & bad lots. OC-curve shows the relationship between the probability of acceptance & the lot quality P'.

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