D 70366 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2019

(CUCBCSS—UG)

Statistics

STS 5D 02—QUALITY CONTROL

Time : Two Hours Maximum : 40 Marks

Use of calculator is permitted.

Section A

Answer all **five** *questions.*

Each question carries 1 *mark*

1. To ensure that the proportion of defective items in the manufactured product is not too large is called ———.
2. The expected value of sample size required for coming to a decision about the acceptance or rejection is called ———.
3. The control chart which is commonly used to control the variation of quantitative characteristic is ———.
4. Probability of rejecting a lot with $100p$ as the process average percentage defectives is called ———.
5. ——— distribution is commonly used to construct C chart.

(5 × 1 = 5 marks)

Section B

Answer all **five** *questions.*

Each question carries 2 *marks.*

6. What is meant by statistical quality control ?
7. What are the advantages of process control ?
8. What is the application of C Chart.
9. What are producers and consumers risk ?
10. What do you understand by acceptance sampling ?

(5 × 2 = 10 marks)

Turn over

the 5 sets of samples drawn ~~for~~ at random from the lot.

11. Section C (2 marks)

Quality. — 2 marks

Difference — 3

Section C

Answer any **three** *questions.*
Each question carries 5 *marks.*

11. What is meant by quality of a product? What is the basic difference between X chart and R chart ?
12. Distinguish between assignable causes and chance causes of variation.
13. State the causes producing variation in the quality of a product.
14. Distinguish between control chart for variables and chart for attributes. Write one method for each.
15. Explain need and utility of statistical quality control in industry.

(3 × 5 = 15 marks)

Section D

Answer any **one** *questions.*
Each question carries 10 *marks.*

16. Explain the relationship between control limits and natural tolerance limits.
17. Define : AQL, LTPD, AOQL and Explain the construction of R-chart.
18. Ten samples of size 5 each are drawn at regular intervals from a manufacturing process. The sample means and range are given below :

Sample Number	:	1	2	3	4	5	6	7	8	9	10
Sample Mean	:	49	45	48	53	39	47	46	39	51	45
Sample Range	:	7	5	7	9	5	8	8	6	7	6

Construct chart for mean and range. Comment on the control of the process.

(10 × 1 = 10 marks)

Key Set (1).

S - 70366 V Semester BA/BSc/B.Com/BBA Degree Examination
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STS 5D 02 - QUALITY CONTROL.

1. Process Control
2. ASN
3. $\bar{x}$ & R chart
4. Producer's risk.
5. Poisson Distribution. (1 marks each)

Section B.

6. Quality Control is a powerful productivity technique for effective diagnosis of defect of quality, process, machine or end product. Statistical (2) quality Control is the effective use of data for studying cause of variation

7. Control and maintain the quality of manufactured product so that it conforms to specified quality (aim). (2)

8. It has a lot of applications in industry.
(1) Imperfections in a bale of cloth, Surface defects of all type of observed roll of Coated paper (Two ones — 2 marks)

9. Producers Risk = $P[\text{rejecting a lot of quality } \bar{p}] = \alpha$.
$\bar{p}$ = process average fraction defective
Consumers risk = $P[\text{accepting a lot of quality } p_t] = \beta$
p_t = Risk on the part of quality of Consumer
(1 marks each)

10. Practical & Economic Considerations - Sampling procedures are adopted to decide whether a lot is rejected or accepted on the basis of samples drawn ~~for~~ at random from the lot. (2 marks)

11. Section C

Quality. — 2 marks

Difference — 3
For $\bar{x}$ chart, the central line is drawn as a horizontal line at $\bar{x}$
For R chart, it is at $\bar{R}$
$\bar{x}$ chart reveals undesirable variations between samples
R chart - within samples

12. Chance — the patterns of variations which are inherent in any particular scheme of production and inspection.
Assignable — variations due to non random causes. (5 Marks)

13. Substandard raw material, new techniques or operations, wrong or improper handling of machine, faulty equipment, unskilled labours
— Any five — 5 Marks.

14. ~~VS~~ variables — These charts may be applied to any quality characteristics that are measurable.
Attributes :— can be used for quality characteristics.
1. $\bar{X}$ - chart — Vble
2. P chart — Attribute.
5 (3+2) = 5 Marks.

15. Helps in detection and correction of many production troubles. It tells ~~us~~ when to leave the process alone and when to take actions.
If testing is ~~not~~ destructive, a process in control gives confidence in the quality.
Provide better quality assurance at a lower inspection cost.
(5 Marks)

16 If μ & σ are the process average and S.D, then $\mu \pm 3\sigma$ are called natural tolerance limits. If μ & σ are not known, the estimates of tolerance limits are

$$\bar{\bar{X}} \pm \bar{R}/d_2 \text{ or } \bar{\bar{X}} \pm 3/c_2$$

Even though the process is in control, Consumer may not be satisfied with the product. This happens when the process diversion ~~is~~ from specification limits (fixed by the customer). These specifications are generally given in upper and lower Tolerance limits.
(10 Marks)

17. A.Q.L — A lot with relatively small fraction defective 'p_1', is some times referred as a good one.

$P[\text{Rejecting a lot of quality } p_1] = .05$

$\Rightarrow P_a = P[\text{accepting a lot of quality } p_1] = .95$.

p_1 is known as acceptance Quality level (A.Q.L)

LTPD — Lot Tolerance Proportion or Percent Defective
The lot tolerance proportion defective usually

17. A.O.Q.L - Average out going quality limit.

The expected fraction defective remaining in the lot after application of the Sampling inspection plan is termed as A.O.Q.L.

Explanation → (10 Marks)

Explain

18. $\bar{\bar{x}} = \frac{462}{10} = 46.2$

$\bar{R} = \frac{68}{10} = 6.8.$

$n = 5$ $A_2 = 0.58$, $D_2 = 0$ and $D_4 = 2.11$

$\bar{x}$ Chart: $UCL = \bar{\bar{x}} + A_2\bar{R}$

$= 46.2 + .58 \times 6.8$

$= 46.2 + 3.944$

$= 50.144$

$LCL_{\bar{x}} = \bar{\bar{x}} - A_2\bar{R}$

$= 42.256.$

$CL = 46.2$

R-Chart: $LCL_R = 0$

$UCL_R = D_4\bar{R} = 2.11 \times 6.8 = 14.348.$

$CL = 6.8$

Draw chart - Comment - (10 5+5 Tens Marks)