SATAVAHANA UNIVERSITY, KARIMNAGAR.

Department of Statistics

CBCS Pattern with Semester System (w.e.f.2016-2017)

B.Sc (Statistics) III Year- Semester –V

Paper –VI

(Statistical Quality Control and Reliability)

(Question Bank for Practical Examinations)

UNIT – I

1. You are given the values of sample mean X-bar and the range for ten samples of size 5 each. Draw mean and range charts and comment on the state of control of the process.

Sample No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
X-bar	**43**	**49**	**37**	**44**	**45**	**37**	**51**	**46**	**43**	**47**
R	**5**	**6**	**5**	**7**	**7**	**4**	**8**	**6**	**4**	**6**

You may use the following control charts constants:

For n= 5. A_2 = 0.58 D_3 =0 and D_4 =2.11

2. The following data give the measurements of the axles of bicycle wheels.12 samples were taken so that each sample contains the measurements of 4 axles. The measurement which was more than 5 inches are given here. Obtain trial control limits for X-bar and R –charts and comment whether the process is under control or not.

139	**140**	**142**	**136**	**145**	**146**	**148**	**145**	**140**	**140**	**141**	**138**
140	**142**	**136**	**137**	**146**	**148**	**145**	**146**	**139**	**140**	**137**	**140**
145	**142**	**143**	**142**	**146**	**149**	**146**	**147**	**141**	**139**	**142**	**144**
144	**139**	**141**	**142**	**146**	**144**	**146**	**144**	**138**	**139**	**139**	**138**

For **n=4 A_2 = 0.73 D_3 =0 and D_4 =2.28**

3. In a glass factory, the task of quality control was done with the help of mean (X-bar) and standard deviation (σ) charts.18 samples of 10 items each were chosen and then values ΣX and Σs were found to be 595.8 and 8.28 resp.Determine the 3-σ limits for standard deviation chart. You may use the following control factors for your conclusions:

n	A_1	B_3	B_4
10	1.03	0.28	1.72

4. If the average fraction defective of a large sample of a product is 0.1537. Calculate control limits (Given that sub-group size is 2,000).

What modification do you need if the sub-group size is not constant?

5 A daily sample of 30 times was taken over a period of 14 days in order to establish attributes control limits. If 21 defective were found. What should be the upper and lower control limits of the proportion of defectives?

6. The following figures give the number of defectives in 20 samples, each containing 2,000 items.

425	430	216	341	225	322	280	306	337	305
356	402	216	264	126	409	193	326	280	389

Calculate the values for central line and the control limits for p-chart .

7. An inspection of 10 samples of size 400 each from 10 lots revealedcthe following number of defective items.

17 15 14 26 9 4 19 12 9 15

Calculate control limits for the number of defective units. Plot the control limits and the observations and state whether the process is under control or not.

8. The past records of a factory using quality control methods show that on the average 4 articles produced are defective out of a batch of 100.What is the maximum number of defective articles likely to be encountered in the batch of 100, when the production process is in a state of control?

9. Constract the 3-σ control limits for Standard Deviation Chart.

10. Distinguish clearly between control charts for variables and control charts attributes.

UNIT-II

11. During an examination of equal length of cloth, the following are the number of defects observed:

2 3 4 0 5 6 7 4 3 2

Draw a control chart for the number of defects and comment whether the process is under control or not?

12. The following table shows the number of missing rivets observed at the time of inspection of 15 Aircrafts. Find the control limits for the number of defects chart and comment on the state of control.

Air Craft No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
No. of missing Rivets.	**7**	**12**	**3**	**20**	**21**	**5**	**4**	**3**	**10**	**8**	**0**	**9**	**6**	**7**	**20**

13Explain Specification limits and tolerance limits..

14. 10 computers were examined for quality control test. The number of defects for each computer is given below:

2 3 6 7 4 2 3 4 1 1

Draw a suitable control chart and comment.

15. Explain process capability index.

16. Construct the 3-σ control limits for U-Chart.

17. Discuss C-Chart and its applications.

18. The following table gives the average number of outlets leaks per radiator for 10 lots of 100 radiators each.

Lot no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
No.of outlet Leaks.	**15**	**17**	**12**	**16**	**14**	**5**	**14**	**11**	**9**	**10**

Draw u-chart and state whether the process is under statistical control.

19 Explain the concept of Six –Sigma and its importance.

20. Construct u-chart(c-chart for variable sample size) to the following data and to state whether the process is under statistically quality control.

Lot No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sample Size	**100**	**120**	**110**	**120**	**130**	**150**	**135**	**125**	**160**	**140**
No.of Defectives.	**15**	**17**	**12**	**16**	**14**	**5**	**14**	**11**	**9**	**10**

UNIT-III

21. Explain types Acceptance Sampling plans.

22. Define Producers risk and Consumers risk.

23. Define AQL and ASN

24. Define LTPD and AOQL.

25. Draw a flow chart of Single sampling plan

26. For a single sampling plan, 2000, $n_1 = 100, c = 2$. Find P_a

When **p= 0.005,0.001,0.05,0.1** and also calculate (i) AOQ curve

(ii) ATI curve

(iii) OC curve

(iv) AOQL value

27. Draw a flow chart of Double Sampling plan.

28. Write down ASN and ATI of Single Sampling Plan

29. Write down ASN and ATI of Double Sampling Plan

30. Define OC curve and explain the construction of OC Curve.

UNIT-IV

31. In a survival test conducted on 100 cards boxes for their strength under impact loading the following results were obtained:

No.of Impacts	**20**	**22**	**24**	**26**	**29**	**32**	**35**	**37**	**40**
No.of boxes failed.	**7**	**10**	**15**	**14**	**15**	**13**	**13**	**8**	**5**

Compute the failure density, failure rate , reliability and probability of failure.

32. Given reliability function $\mathbf{R(t) = e^{-\sqrt{(0.001t)}}\ ;\ t \geq 0}$

(i) Compute reliability for a 50 hours machine.

(ii) Given a 10 hours wear –in-period. Compute the reliability for a 50 hours.

(iii) Find Hazard function.

33. The density function of the time to failure component manufactured by a certain company is given is given by $\mathbf{f(t) = 200/(t+10)^3\ ;\ t \geq 0}$

Find (i) Reliability function and the reliability for the first year of operation.

(ii) Compute MTTF

(iii) What is the design life for a reliability 0.95?

34. A system has 10 identical components connected in series It is desired that the system reliability be 0.95.Determine how good each component should be and determine how poor the component reliability can be if the components are connected in parallel.

35. In a hydraulic control system ,the connecting linkage has a reliability factor of 0.98 and the value which has to operate within a certain time limit has a reliability factor of 0.92.The pressure sensor which actuates the linkages has a reliability factor of 0.90.What is the reliability of the control system.

36. A space vehicle requires three out of its four main engines to operate in order to achieve orbit. If engine has a reliability of 0.97, determine the reliability of achieving orbit.

37. Let a parallel system be composed of n= 2 identical components, each with failure rate $\lambda = 0.01$ and time t = 10 hours only one of which is needed for system success. Then find total system reliability and Mean time to failure.

38. Consider a four component system of which the components are identically distributed with constant failure rate. If $\mathbf{R_s(100) = 0.95}$is the specified reliability find the individual component MTTF.

39. Consider a system consisting of three identical units connected in parallel. The unit reliability factor is 0.90.If the unit failures are independent of one another and if the successful operation of the system depends on the satisfactory performance of any one unit determine the system reliability.

40. A system consisting of 5 identical components operates successfully if at least 3 of the 5 components work. If the reliability of each components is 0.4.Find the reliability of the system.

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