

13/11

BITS, PILANI – DUBAI
First Semester IV Year Mech
2007 – 2008

Test I

Course No & Title : ME UC443 Quality Control Assurance & Reliability

Date : 11/11/2007

Time 50 minutes

Max: 25 marks

Answer All Questions

(Approved Statistical Data sheets allowed)

1. What are the major categories of quality costs? Briefly explain them by giving examples.
(4 MARKS)
2. The length of a machined part is known to have a normal distribution with a mean of 100 mm and a standard deviation of 2 mm.
 - a) What proportion of the parts will be above 104 mm?
 - b) What proportion of the parts will be between 97.5 and 102.3 mm?
 - c) What proportion of the parts will be shorter than 96.2 mm?(3 X 3 = 9 MARKS)
3. A state university is considering increasing the enrollment by providing more financial assistance, by making tuition competitive and by making the academic program more rigorous. Prior to these measures, the university found that out of a random sample of 100 prospective students, 30 were interested in attending. After implementing these measures, a random sample of 200 shows that 90 are interested in joining.
 - a) Find a 90% confidence interval for the difference in proportion of students who are interested in attending the university before and after the proposed measures.
(4 MARKS)
 - b) Were the proposed measures effective in increasing the interest of students to attend the university? Use a level of significance of 0.05.
(4 MARKS)
4. State and explain each rule for determining out of control process in a control chart.
(4 MARKS)

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Best of Luck!!!

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Test II (Open Book)

(Class Notes, text, reference book, data books allowed)

Course No & Title : ME UC443 Quality Control Assurance & Reliability

Date : ~~14/12/2007~~ 16/12/07

Time 50 minutes

Max: 20 marks

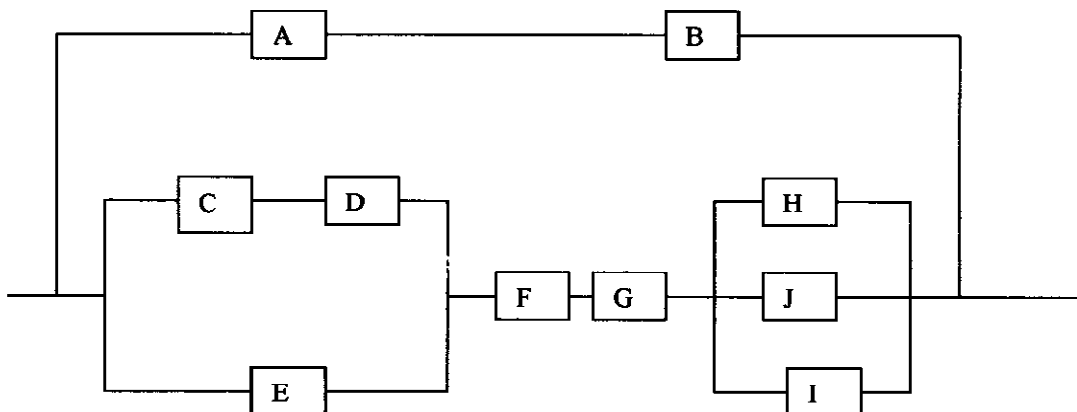
Answer All Questions

1. Assume that you have recently taken charge as quality Control Manager in a reputed restaurant/bank/automobile service center. Off late, customers make many complaints on the delay in service, which is spoiling the goodwill of the company. The CEO relays on you to identify and solve the problem. Your task is to formulate a time frame for each type of delivery and identify the nonconformity using a suitable control chart. Describe with examples how you will go about this? (8)
2. In a textile company, it is important that the acidity of the solution used to dye fabric be within certain acceptable values. Data values are gathered for a control chart by randomly taking four samples from the solution and determining the average pH value and range. After 25 such samples, the following summary information is obtained.

$$\sum_{i=1}^{25} X_i = 195, \quad \sum_{i=1}^{25} R_i = 10$$

The specifications for the pH value are 7.5 ± 0.5 .

- a) Find the X and R chart control limits.
 - b) Find the 1σ and 2σ X chart limits.
 - c) Assuming a normal distribution of pH values, what fraction of the output is nonconforming? (6)
3. Consider the ten-component system shown in the following figure. Assume that the time to failure for each component has an exponential distribution. The failure rates are: $\lambda_A=0.0001/h$, $\lambda_B=0.0002/h$, $\lambda_C=0.0003/h$, $\lambda_D=0.0004/h$, $\lambda_E=0.0005/h$, $\lambda_F=0.0006/h$, $\lambda_G=0.0007/h$, $\lambda_H=0.0008/h$, $\lambda_I=0.0009/h$, $\lambda_J=0.0010/h$. Find the reliability of the system after 1000 h. What is the mean time to failure of the system? (6)



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First Semester IV Year Mech
2007 – 2008

Comprehensive Exam (Closed book)

(Statistical data books are allowed. Graph sheets may be used for drawing charts)

Course No & Title : ME UC443 Quality Control Assurance & Reliability

Date: 03/01/2008

Time 10.00 AM to 1.00 PM

Max: 40 marks

Answer All Questions

1. Explain how quality affects productivity. Discuss the implications on cost. (3)
2. What are the benefits of using control charts? (2)
3. Define and explain type I and Type II errors in the context of control charts. Are they related? (3)
4. A manufacturing process is estimated to produce 5% nonconforming items. If a random sample of five items is chosen, find the probability of getting two nonconforming items. (2)
5. It is estimated that the average number of surface defects in 20 square meter of paper produced by a process is 3. What is the probability of finding no more than 2 defects in 40 square meter of paper through random selection? (3)
6. It is known that a battery for a video game has an average life of 500 h. The failures of batteries are known to be random and independent and may be described by an exponential distribution.
 - a. Find the probability that a battery will last at least 600h.
 - b. Find the probability of a battery failing within 200h.
 - c. Find the probability of a battery lasting between 300h and 600h.
 - d. If it is known that a battery has lasted 300 h, what is the probability that a battery will last at least 500h? (6)
7. A company is interested in determining whether the proportion of nonconforming items are different for two of its vendors, A random sample of 100 items from the first vendor revealed 4 nonconforming items. A random sample of 200 items from second vendor showed 10 nonconforming items. What is your conclusion? Test at a level of significance of 0.05. (4)
8. An analyst wishes to estimate the thickness of magnetic coating on an audio tape. Random samples of size 4 are selected. Following table shows the, mean and standard deviation for 20 samples. The specifications are 38 ± 4.5 microns. If a coating thickness is less than the specifications call for, the tape can be used for a different purposes by running it through another coating operation
 - a. Find the trial control limits for an \bar{X} and s chart.
 - b. Assuming special causes for the out of control points, determine the revised control limits.
 - c. Assuming the thickness of the coating is normally distributed, what proportion of the product will not meet specifications?
 - d. If the process average shifts to 37.8 microns, what proportion of the product will be acceptable? (6)

Sample	Sample Mean	Sample standard deviation
1	36.4	4.6
2	35.8	3.7
3	37.3	5.2
4	33.9	4.3
5	37	4.4
6	35	3.9
7	38.6	5
8	39.4	6.1
9	34.4	4.1
10	39.5	5.8
11	36.7	5.3
12	35.2	3.5
13	38.3	4.7
14	39	5.6
15	35.5	5
16	37.1	4.1
17	38.3	5.6
18	39.2	4.8
19	36.8	4.7
20	37.7	5.4

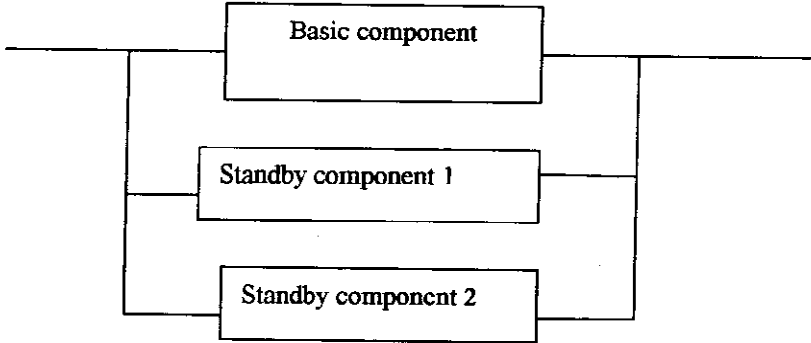
9. Data for the number of dissatisfied customers in a departmental store observed for 25 samples of size 300 is shown in the following table. Construct an np-chart for the number of dissatisfied customer. (5)

Sample	Number of dissatisfied customers
1	10
2	12
3	8
4	9
5	6
6	11
7	13
8	10
9	8
10	9
11	6
12	19
13	10
14	7
15	8
16	4
17	11
18	10
19	6
20	7

10. Find the reliability of the standby system shown below with one basic component and two standby components, each having an exponential time to failure distribution. The failure rate for each component is 0.04/h and the period of operation is 300h.
- What is the mean time to failure?
 - If the three components are in parallel, what is the reliability of the system?

c. What is the mean time to failure in this system?

(6)



Best of Luck!!!