

BITS, PILANI – DUBAI
First Semester IV Year 2008 – 2009

Test I

Course No & Title : ME C443 Quality Control Assurance & Reliability

Date : 26/10/2008

Time 50 minutes

Max: 50 marks

Answer All Questions

(Approved Statistical Data sheets allowed)

1. Explain the various costs involved in implementing quality control process.
(5 Marks)
2. List the Demings's 14 points for the quality management.
(7 Marks)
3. A random sample of 20 observations on the oil consumption between service for a vehicle are as follows:
29.1, 32.2, 29.5, 36.0, 31.5, 34.5, 33.6, 27.4, 30.4, 28.4, 32.6, 31.9, 32.3, 28.2, 27.5, 34.9, 32.8, 27.7, 30.2, 28.5
 - a) Find the mean, median, and standard deviation and interpret them
 - b) Find the interquartile range, skewness and kurtosis coefficient. Comment on them
(15 Marks)
4. The output voltage of a wind turbine is known to have a standard deviation of 10 V. Fifty readings are randomly taken in a week, yielding an average of 238 V. With a 95% confidence level, calculate the range of voltage fluctuation from the observed mean voltage.
(8 MARKS)
5. Refer the data in question number 3.
 - (a) For this data construct a control chart and explain the steps involved.
 - (b) If the control limits are placed at 3 times the standard deviation, what is the probability of Type I error?
(15MARKS)

* * *

Best of Luck!!!

BITS, PILANI – DUBAI
First Semester IV Year Mech
2008 – 2009

Test II (Open Book)

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

Course No & Title : ME C443 Quality Control Assurance & Reliability

Date : 10/12/2008

Time 50 minutes

Max: 40 marks

Answer All Questions

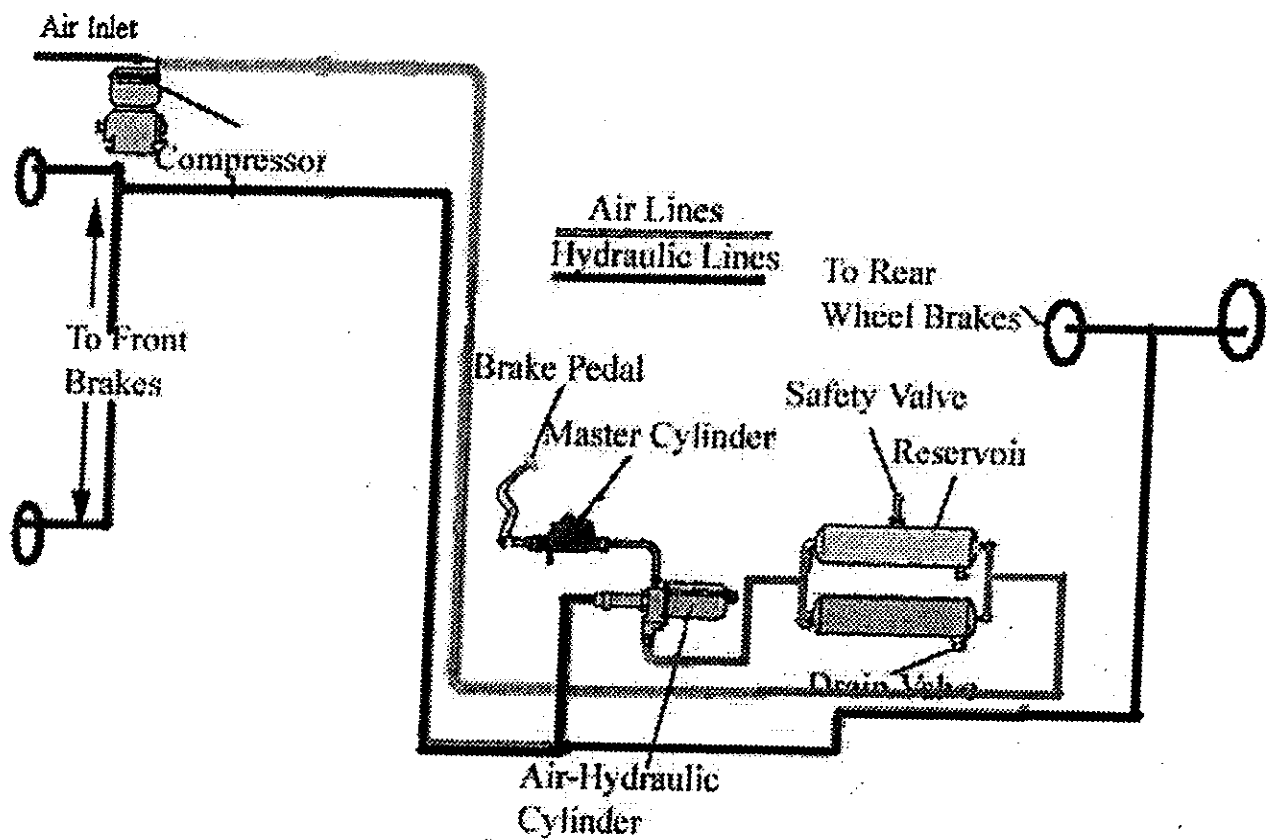
1. Assume that you have recently taken charge as Quality Control Manager in a reputed shopping mall. Off late, customers make many complaints on the delay in home delivery of ordered items, which is spoiling the goodwill of the company. But, the delivery man says he is on time for most of the orders but only on rare occasion he gets delayed. 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 an example how you will go about this?
(10)
2. In a tire manufacturing company, following defective tires were observed for the different lots of tires produced. Construct a chart to compare the proportions of defects observed in different lots. Use control limits based on individual samples, average sample size and a representative sample size and comment your observations.
(15)

| Sample | Lot size Inspected | No of defective tires |
|--------|--------------------|-----------------------|
| 1 | 50 | 4 |
| 2 | 90 | 6 |
| 3 | 100 | 8 |
| 4 | 90 | 7 |
| 5 | 80 | 8 |
| 6 | 40 | 6 |
| 7 | 50 | 6 |
| 8 | 50 | 5 |
| 9 | 110 | 11 |
| 10 | 70 | 6 |

3. The figure in the next page shows the air-over hydraulic brake system used in heavy vehicles. The performance of the braking system depends upon the performance of individual components that are connected in series and parallel. Develop a reliability model for the system shown. Assume that the wheel brakes are working simultaneously for effective braking. The reliability of the component is measured by their response time for mechanical and hydraulic actuators and by the pressure drop for pneumatic components. The reliability of the braking system is the measure of response time and pressure drop. The time delay in response for the components is: Brake Pedal = 20 ms, master cylinder = 15 ms, air-hydraulic cylinder = 10 ms, wheel brakes = 20 ms; the pressure drop in air compressor = 0.16 bar, air tanks = 0.08 bar. For 1 second braking time and for 8 bar air pressure, calculate the reliability of the braking system. (Hint: Reliability = 100 - response time or pressure drop in percentages)
(15)

* * *

Best of Luck!!!



Name _____

ID No. _____

BITS, PILANI – DUBAI
First Semester IV Year Mech
2008 – 2009

Quiz - I

Course No & Title : ME C443 Quality Control Assurance & Reliability

Answer All Questions (10X 1=10 marks)

1. The hypothesis that we wish to prove or establish is called _____ hypothesis.
2. The mean and standard deviations are equal for _____ distribution.
3. The power of significance test is
 - a) $\alpha = P(\text{Rejecting } H_0/H_0 \text{ is true})$
 - b) $\beta = P(\text{Accepting } H_0/H_0 \text{ is false})$
 - c) $1-\alpha = P(\text{Accepting } H_0/H_0 \text{ is true})$
 - d) $1-\beta = P(\text{Rejecting } H_0/H_0 \text{ is false})$
4. For the data $\sigma = 4.2$, $B=0.8$, $Z_{0.025} = 1.96$, the sample size $n =$ _____
5. According to Central Limit Theorem, the standard deviation of the sample mean is _____
6. Range is defined as $R =$ _____
7. Give an example for one-tailed test.
8. The Weibull distribution approaches the normal distribution for $\gamma =$ _____, $\beta =$ _____.
9. The life cycle of a component with a constant failure rate can be modeled by _____ distribution.
10. The loss of all sampling units is called _____.

Best of Luck!!!

Name _____

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BITS, PILANI – DUBAI
First Semester IV Year Mech
2008 – 2009

Quiz II

Course No & Title : ME C443 Quality Control Assurance & Reliability

Answer All Questions (10X 1=10 marks)

1. The p -chart and np chart are based on
 - (a) Normal Distribution,
 - (b) Binomial distribution,
 - (c) Poison distribution
 - (d) Exponential distribution
2. The _____ control chart is made based on weighted basis.
3. One of the disadvantages of attributes chart is it does not specify the degree to which specifications are not met. (T/F)
4. For an np chart select the Upper control limit is given by the equation:
 - a) $UCL = np + \sqrt{p(p-1)}$
 - (b) $UCL = np + \sqrt{p(1-p)}$
 - c) $UCL = np + \sqrt{np(p-1)}$
 - (d) $UCL = np + 3\sqrt{np(p-1)}$
5. The np chart is not used when the sample size varies (T/F)
6. c -chart is based on _____ distribution.
7. Taste and smell are _____ quality characteristics where as length of a chocolate bar is _____ quality characteristics.
8. Name few statistical software used for plotting control charts.
9. List the different methods used to plot the control charts for samples vary in size.
10. Differentiate non-conforming and non-conformities of a product.

Best of Luck!!!

BITS, PILANI – DUBAI
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2008 – 2009

Quiz ~~1~~ 3

Course No & Title : ME C443 Quality Control Assurance & Reliability

Answer All Questions (10 marks)

1. The reliability of a system is higher than its component's reliability when the components are connected in _____
2. An example of a system having components connected in parallel _____
3. For the failure rate having exponential distribution the mean time to failure (MTTF) = _____
4. The probability of a product performing its intended function for a stated period of time is called _____
5. For repairable component the mean time between failure is equal to _____
6. The debugging phase of is also called _____
7. Draw a typical life cycle curve and mark the different phases (Use the space below) (2 marks)

(Use back side)

8. Distinguish between time terminated and failure terminated tests.

(2marks)

BITS, PILANI – DUBAI
First Semester IV Year Elective
2008 – 2009

Comprehensive Exam (Closed book)

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

Course No & Title : ME C443 Quality Control Assurance & Reliability

Date: 31/12/2008

Time 10.00 AM to 1.00 PM

Max: 80 marks

Weightage: 40%

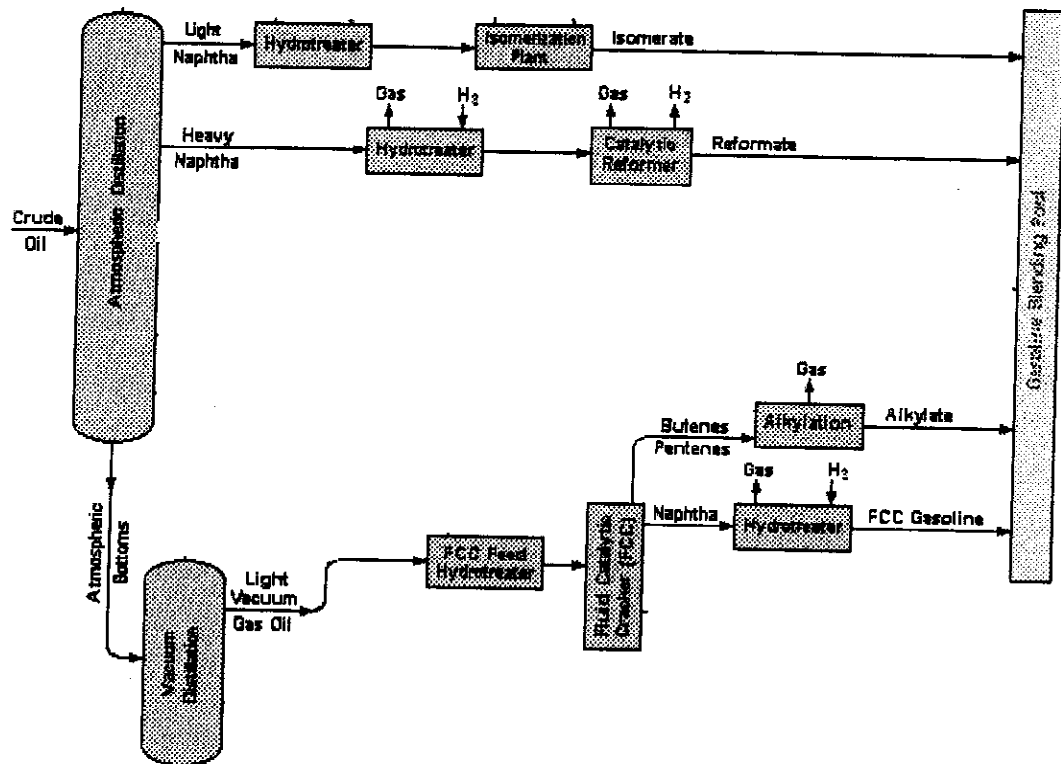
Answer All Questions

1. (a) When you implement a quality control scheme in a company, how the various expenses involved will vary with time? Explain with an example. (8)
(b) What is a quality circle? (2)
2. (a) Briefly describe about the Deming's System of Profound Knowledge. (5)
(b) Explain the Quality trilogy of Joseph Juran with a chart. (5)
3. Two operators perform the same operation. As their supervisor, you want to estimate the difference in the mean machining times between them. No assumptions can be made as to whether the variability of machining time is the same for both operators or not. It can be assumed, however, that the distribution of machining times is normal for each operator. A random sample of 20 from the first operator gives an average machining time of 42 min with a standard deviation of 4 min. A random sample of 60 from the second operator yields an average of machining time of 51 min with a standard deviation of 8 min. Find a 95% confidence interval for the difference in the mean machining times between the two operators. (10)
4. The thickness of sheet metal used for making car bodies is to be checked for quality assessment. Random samples of size 10 are taken. The average and standard deviation are calculated and are shown in the following table for 10 such tests. The car body manufacturer specifies that the sheets thickness should be 10 ± 0.2 mm.

| Test No | Sample average | No of Sheets not confirming to the specification | Sample Standard Deviation |
|---------|----------------|--|---------------------------|
| 1 | 10.19 | 1 | 0.15 |
| 2 | 10.30 | 2 | 0.12 |
| 3 | 9.87 | 1 | 0.18 |
| 4 | 9.45 | 2 | 0.19 |
| 5 | 10.22 | 1 | 0.14 |
| 6 | 11.34 | 3 | 0.26 |
| 7 | 9.23 | 2 | 0.18 |
| 8 | 9.82 | 3 | 0.09 |
| 9 | 10.54 | 2 | 0.15 |
| 10 | 9.45 | 1 | 0.09 |

- (a) Find the control limits for \bar{X} and s chart and plot the control charts. Revise the control charts if there is any out of control points.
 - (b) Estimate the process mean and process standard deviation. (10)
5. For the problem given in question 4, construct the np chart for the number of out of specification sheets. Identify the out of control points and revise the chart if necessary. (10)
 6. For the data given in problem 4. Construct an OC curve as a function of the process average proportion nonconforming with the probability of Type II Error. (10)

7. A control chart is to be constructed for the average breaking strength of nylon fibers. Samples of size 10 are randomly selected and the process mean and standard deviation are estimated to be 150 kg and 7 kg. If the control limits are placed at 3 times standard deviations from the process mean, what is the probability of Type I error? (10)
8. Following figure shows a part of the Gasoline distillation system from crude oil. Assume all the distillation sub systems are having a reliability of 95.5%. For the output of gasoline from the crude oil, three different paths are available from the atmospheric distillation. Calculate the reliability of the entire system that produces gasoline from crude oil. (10)



Best of Luck!!!