

MN 249

STATISTICAL PROCESS CONTROL



**STUDENT STUDY MANUAL FOR
CHALLENGE EXAMINATION**

FALL 2009

DEPARTMENT: Manufacturing Department

COURSE TITLE: MN 249 Statistical Process Control

A. Course Description

Simple statistical procedures for the control of manufacturing processes; data are gathered from processes, product flow charts, and cause-and-effect diagrams for the construction of variable and attribute charts. Students learn to interpret statistics, capability studies, reliability, and quality cost.

B. Student Performance Objectives

The student must complete the examination with a 75% or greater score on EACH of the five part examination to receive MN249 credit. To successfully complete this examination a student must be able to:

1. Operate a statistical calculator to find the measures of central tendency and measures of dispersion.
2. Explain the contributions of the Quality Advocates: Shewhart, Deming, Juran, Feigenbaum, Taguchi, Crosby, Ishikawa.
3. Calculate the area under the normal curve using z-scores.
4. Explain the theory of R & R studies.
5. Determine process capability. (CR, CP, Cpk)
6. Explain and interpret variable and attribute control charts.
7. Explain and interpret quality cost information.
8. Calculate and interpret probability and statistics measures (Binomial, Poisson, Hypergeometric, Normal)
9. Calculate and interpret reliability measures.
10. Explain Taguchi's contributions to quality.

C. Testing Conditions

When you come to take the examination you should bring : Pencils and a scientific calculator.

D. Test Format and Procedures

- Fill out request form available in the Manufacturing Office to take the test.
- Make an appointment to take the test.
- Pay fee to take test at Cashiers office. Bring receipt when you come to take the test.
- Take the test
- A letter from the registrar's office will notify you of the results.

If successful, paying tuition at a rate of 40% of the resident rate will officially post the credit.

Please Note. Credit will be posted on a credit/no credit basis. Some colleges do not give credit for CE. Be sure to check with your transfer college.

Reference material:

Quality 5th edition by: Donna Summers
Statistical Quality Control by: Besterfield

This test will take approximately 4 hours.

Sample Statistics and Probability Problems

- The average time a person spends at the West Newton Zoo is 62 minutes. The standard deviation is 12 minutes. If a visitor is selected at random, find the percentage chance that he or she will spend the following time at the zoo. Assume the variable is normally distributed.
 - At least 82 minutes *Ans. 4.75%, 15.75%*
 - At most 50 minutes
- A survey found that people keep their television sets an average of 4.8 years. The standard deviation is 0.89 year. If a person decides to buy a new TV set, find the probability that he or she has owned the old set for the following amount of time. Assume the variable is normally distributed.
 - less than 2.5 years *Ans. .005, .162*
 - between 3 and 4 years
- A box contains 24 transistors, four of which are defective. If four are sold at random, find the following probabilities using the hypergeometric distribution.
 - Exactly two are defective. *Ans. .107, .456, 0*
 - None are defective
 - All are defective
- In a shipment of 25 microwave ovens, 2 are defective. If two ovens are randomly selected and tested, find the probability that both are defective if the first one is not replaced after it has been tested. *Ans. .003*
- The probability of a tourist visiting Indian Caverns is .80 and of visiting Safari Zoo is .55. The probability of visiting both places on the same day is .42. Find the probability that a tourist visits Indian Caverns or visits Safari Zoo. *Ans. .93*
- If one card is drawn from an ordinary deck of cards, find the probability of getting the following. *Ans. .231, .750*
 - A king or a queen or a jack
 - A club or a heart or a spade
- Public Opinion* reported that 5% of Americans are afraid of being alone in a house at night. If a random sample of 20 Americans is selected, find these probabilities using the Binomial Probability distribution. *Ans. .002, .984, .0754*
 - There are exactly five people in the sample who are afraid of being alone at night.

- b. There are at most three people in the sample who are afraid of being alone at night.
- c. There are at least three people in the sample who are afraid of being alone at night.

8. A student takes a 10 question, true-false exam and guesses on each question. Find the probability of passing if the lowest passing grade is 6 correct out of 10 (Binomial) *Ans. .377*

9. If 3% of all cars fail the emission inspection, find the probability that in a sample of 90 cars, three will fail. Use the Poisson approx. *Ans. .220*

10. The average number of phone inquiries per day at the poison control center is four. Find the probability it will receive five calls on a given day. Use the Poisson approx. *Ans. .156*

11. How many ways can four books be arranged on a shelf if they can be selected from nine books? (use permutations) *Ans. 3024*

12. How many ways can a person select 8 videotapes from 15 tapes? (use combination) *Ans. 6435*

13. Given the following data set, calculate the 3 measure of central tendency and the 3 measure of dispersion. *Ans. 27.33,25,25*

29. 7.995,63 920

22,23,21,25,24,32,24,33,39,40,13,28,25,25,42

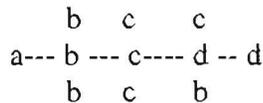
14. Calculate CR,CP, and Cpk for the given information and interpret the information.

Specification $.0625 \pm .0015$ Sample Avg. = .0624
 Sample Std. Deviation = .00025
 Sample Size = 80

Ans. CR=.69,CP=1.45,Cpk=1.30

15. Calculate the following system reliability.

- R(a) = .995
- R(b) = .850
- R(c) = .750
- R(d) = .920



Ans. .8954

Sample Quality Theory Questions

Here are some general Quality Theory questions. The challenge examination will have 5 questions like these. Students should know content and theory of the following questions in addition to material on Quality techniques, Quality cost, Auditing, Charting Theory, Design of Experiments fundamentals

1. Explain in detail the contributions of the following quality advocates:
 - a. Dr. Shewhart
 - b. Dr. Joseph Juran
 - c. Dr. Deming
 - d. Dr. Ishikawa
 - e. Dr. Feigenbaum
2. List the four absolutes of quality management and the five erroneous assumptions according to Philip Crosby?
3. Explain the theory of the Loss Function?
4. Discuss the concept of best practices or continuous improvement?
5. How can I prove continuous improvement an attribute chart?
6. Explain the two basic functions of control charts?
7. Define variation, and provide an application for each of the three types of variation?
8. What is the difference between assignable causes and chance causes?
9. Explain why each variable control chart is divided into two sections?
10. Explain the theory of the three cases concerning process capability?

Answer to all of these questions will be located in most Basic Statistical Process Control Textbooks.

Quality 5th Edition by. Donna Summer
Statistical Process Control by. Dale Besterfield