SQC & OR Unit

Indian statistical Institute,8th Mile Mysore Road,Bangalore-560059

M.S.(Quality Management Science) (2018-2019)
Semester I-July 2018

Paper :Reliability, Maintainability and Safety

Time: 2 Hours Date: 11 September, 2018 Max. Marks: 50

This paper carries "55" Marks. Answer as many questions as you can but the maximum marks you can score is "50"

1. A sample of two printed circuit boards is selected without replacement from a batch that contains "90" boards that are not defective, "8" boards with minor defects and "1" board with major defect. Describe the ordered sample space for this trial (2)
2. Four bits are transmitted over a digital communication channel. Each bit is either distorted or received without distortion. Let A_i denote the event that "i" th bit is distorted, i=1,2,3,4. Are the A_i's mutually exclusive ? Describe the outcome of the events (a) A_1 (b) A_1^c (c) $A_1 \cap A_2 \cap A_3 \cap A_4$ (d) $(A_1 \cap A_2) \cup (A_3 \cap A_4)$ (5)

3. A batch of "500 " machined parts contains "10" that do not conform to customer requirements. Parts are selected successively without replacement until a nonconforming part is obtained. The random variable is the number of parts selected .What is the range (possible values) of the random variable? (2)

4. In answering a question on a multiple choice test, an examinee either knows the answer (with probability ' p') or he guesses (with probability '1-p'). Let the probability of answering the question correctly be '1' for an examinee who knows the answer and '1/m' for one who guesses ('m' being the number of multiple choice alternatives).Suppose an examinee answers a question correctly, what is the probability that he really knows the answer? (8)

5. What is the probability that 'r' individuals have different birthdays ? Also show that the probability is approximately equal to "$e^{-r(r-1)/730}$ ". How many individuals are required to make the probability of distinct birthdays less than " ½ " ? (10)

6. Given probability density function (pdf)

$$f(x) = k*x*(1-x) \quad \text{for } 0<x<1$$
$$= 0 \quad \text{otherwise}$$

Find "k" and the cumulative distribution function (cdf). Sketch the cdf (10)

7.

a. Derive the expressions for the moment generating function for Geometric random variable with parameter 'p'
b. Explain the meaning of "Geometric distribution is said to lack any memory"
c. An installation technician for a specialized communication system is dispatched to a city only when three or more orders have been placed. Suppose on an average 0.25 orders are placed per week for a city with a population of 100,000 and suppose your city contains a population of 800,000. If you are the first one in the city to place an order, what's the probability that you have to wait more than two weeks from the time you place your order until a technician is dispatched

(4+2+4=10)

8. The length of an injection molded plastic case that holds magnetic tape is normally distributed with mean 90 millimeters and the standard deviation 0.1 millimeter. Suppose that 10 cases are measured, and they are assumed to be independent.
   a. What is the probability that all 10 cases are between 89.7 and 90.3 millimeters?
   b. What is the expected number of 10 cases that are between 89.7 and 90.3 millimeters?

(5+3= 8)