

Indian Statistical Institute, Bangalore
M.S (QMS) First Year
First Semester - Reliability, Maintainability and Safety I

Mid Term Exam

Time: 2 Hours

Date: 10 September, 2015

Max Marks: 50

This paper carries "55" Marks. Answer as many questions as you can

Question (1): Tick the most appropriate answer for the following questions with justification wherever required

- a) The Probability of a train arriving on time and leaving on time is 0.8. The probability of the same train arriving on time is 0.84. The probability of the same train leaving on time is 0.86. Given the train arrived on time, what is the probability it will leave on time? [3]
- i. 0.93
 - ii. 0.84
 - iii. 0.88
 - iv. 0.95
- b) A medicine with efficacy of 0.52 is given to five patients. Find the approximate probability that at least one of the patients is cured [4]
- i. 0.975
 - ii. 0.480
 - iii. 0.531
 - iv. 0.416
- c) If A, B, C represent three events, the meaning of $P(B' \text{ and } C' | A) = 0.4$ is [1]
- i. Probability of B and C occurring given A has occurred is 0.4
 - ii. Probability of B or C occurring given A has occurred is 0.4
 - iii. Probability of B & C not occurring given A has occurred is 0.4
 - iv. None of the above
- d) The probabilities that there would be 1, 2 or 3 persons riding a bicycle are 0.85, 0.12 and 0.03. What's the expected number of persons per bicycle. [3]
- i. 1.79
 - ii. 2.43
 - iii. 1.18
 - iv. 0.75
- e) Suppose that $P(A | B) = 0.2$ and $P(A | B') = 0.3$ and $P(B) = 0.8$, then $P(A)$ is: [3]
- i. 0.53
 - ii. 0.22
 - iii. 0.73
 - iv. None of the above

Question (2): Decide whether a discrete or continuous random variable is the best model for the following cases: [4]

- (a) The weight of an injection molded plastic part
- (b) The number of cracks exceeding one –half inch in 10 miles of an interstate highway.
- (c) Number of persons per minute at a supermarket’s express checkout station at about 6pm on weekdays
- (d) The volume of gasoline that is lost to evaporation during the filling of a gas tank

Question (3): Define Random Variable and determine the range of the random variables for the following: [1+2+2 = 5]

- (a) 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 no. of parts selected.
- (b) In an acid based titration, the milliliters of base that are needed to reach equivalence are measured to the nearest milliliter between 0.1 and 0.15 liters (inclusive)

Question (4): [4+6 = 10]

- (a) Explain Bayes’s Theorem.
- (b) A factory has three machines A, B and C producing 1000, 2000 and 3000 bolts per day respectively. A produces 1% defective 1.5% and C produces 2% defectives. A bolt is chosen at the end of a day and found defective. What is the probability it comes from machine A?

Question (5): Check whether the statement “The mean of the Binomial Distribution is 5 and Standard deviation is 3” is true or false [7]

Question (6): [4+6 = 10]

- (a) Define Negative Binomial random variable
- (b) A supermarket displays two models A and B of a product. The probability that a customer selects, model A is 0.6 and that he selects model B 0.4. The supermarket starts with 5 A’s and 5 B’s. What is the probability that when 5th A is sold, 3 B’s are in stocks

Question (7): Show that mean and variance of Poisson distribution are same [5]