

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

Mid Term Exam Duration: 2 Hrs Date: September 16, 2017 Max Marks: 50

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

- Question (1):**(i) Let A,B and C be independent events. Then prove that the events A' and (B∩C') are independent
(ii) One shot is fired from each of three guns. Let A,B and C denote the events that the target is hit by the first ,second and the third gun respectively. Suppose P(A) = 0.5,P(B) = 0.6 and P(C) = 0.8.Assuming A,B and C are independent events, what's the probability that exactly one hit is registered
(6+4=10)

- Question (2):** (i)Demonstrate the validity of the equation:
 $P(A\cup B\cup C) = P(A)+P(B)+P(C) - P(A\cap B) - P(B\cap C) - P(A\cap C)+P(A\cap B\cap C)$
for the three events 'A','B' and 'C' in the sample space 'S'
(ii) A corporate website contains errors on 50 of 1000 pages. If 100 pages are sampled randomly without replacement, what's the probability that at least one of the pages in error are in the sample
(4+6=10)

- Question (3):** Machine A,B and C all produce the same two parts X and Y. Of all the parts produced, machine A produces 60%, machine B produces 30% and machine C produces 10%.In addition, 40% of the parts made by machine A are part X, 50% of the parts made by machine B are part X, 70% of the parts made by machine C are part X
A part produced by this company is randomly sampled and is determined to be an X part. With the knowledge that it is an X part, revise the probabilities that the part came from machine A,B or C
(5)

- Question (4):** (i)(a)Show that the mean of the Hyper geometric distribution equals that of the Binomial Distribution with the parameters 'n' the sample size and p= proportion of successes in the set of (a+b) objects = a/(a+b) where 'a' objects are classified as successes and 'b' objects as failure (b) when the sample size 'n' is very small compared to (a+b),the variance of the Hyper geometric distribution approaches that of the Binomial Distribution with p= a/(a+b)
(ii) Flaws occur in the interior of plastic used for automobiles according to a Poisson distribution with a mean of 0.02 flaw per panel (a) If 50 panels are inspected, what's the probability that there are no flaws (b) What's the expected no of panels that need to be inspected before a flaw is found?
(c)If 50 panels are inspected, what's the probability that the number of panels that have one or more flaws is less than or equal to 2? (4+6+3+4+3=20)

- Question (5):** (a) Differentiate between "Failure Density Function: f(t)" and "Hazard Function: h(t)"
(b) Suppose the life in hours of a certain kind electronic component has the density function $f(x) = \begin{cases} 0 & \text{for } x < 100 \\ 100/x^2 & \text{for } x \geq 100 \end{cases}$
What's the probability that none of the three such components in a given electronic equipment will have to be replaced during the first 150 hours of operation? What's the probability that all three of the original components will have been replaced during the first 150 hours ?
(4+6= 10)