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

Mid Term Exam   Duration: 2 Hrs   Date: September 14, 2016   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. Let A,B,C be three arbitrary events. Find expression for the events: [5]
(i) One and no more occurs.
(ii) Two and no more occur
(iii) Not more than two occur and simple expression for
(iv) (AUB)(AUB')
(v) (AUB)(BUC)

2. [4 + 6 = 10]
(i) Demonstrate the validity of the equation: P(AUB)=P(A)+P(B)+P(A∩B)
(ii) A person reports that during a test, the probability of a microbe reacting to drug "A" is 0.62 and to drug "B" is 0.53. Probability that a microbe reacts to both drug "A" and "B" is 0.18 and that it does not react to any one of them is 0.13. Should the report of the test questioned?

3. [5 + 8 = 13]
(i) Explain Bayes's Theorem with examples.
(ii)A bomber carrying three bombs flies directly above a railroad track. If a bomb falls within 40 ft of the track, the track would be sufficiently damaged. With a certain bombsight the density function of point of impact measured in feet from the track is

$$f(x) = \begin{cases} (100 - x)/10000, & 0 < x \le 100 \\ (100 + x)/10000, & -100 \le x < 0 \end{cases}$$

If all the three bombs are used, what's the probability that the track will be sufficiently damaged?

4. [7 + 8 + 5 = 20]
(i) If "X" is a Negative Binomial random variable with parameters "p" & "r", derive σ^2 of X
(ii) In a torture test a spring is compressed until it becomes defective. If the probability that it becomes defective on any one compression is 0.001 and the compressions are independent, what is the probability that it would fail after 1000 compressions?
(iii) A True-False test contains 200 questions. What's the probability that a student who answers just at random will get fewer than 90 correct answers?

5. [3 + 4 = 7]
(i) Differentiate between "Failure Density Function:f(t)" and "Hazard Function:h(t)"
(ii) In a large corporate computer network, user log-ons to the system with a mean of 25 log-ons per hour. What's the probability that there are no
log-ons in an interval of 6-minutes ?