

Indian Statistical Institute, Bangalore

M.S (QMS) First Year

First Semester -Reliability, Maintainability and Safety-I

Final Examination

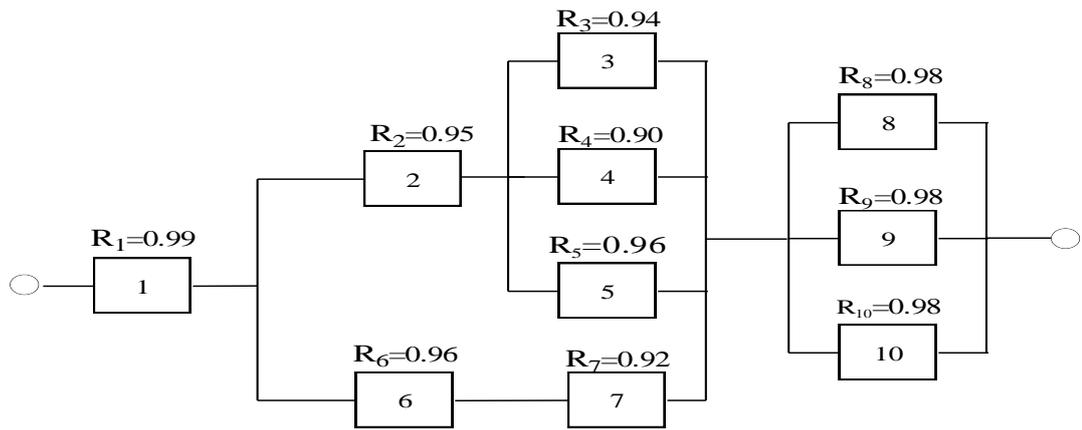
Time: 2.5 hrs.

Date: 15/11/2023

Maximum marks :50

Instruction: This paper has six questions. Answer any five questions. Each question carries 10 marks. Try to answer all parts of a question on the same place.

1. a) Define i) random experiment, ii) sample space, iii) complementary events [6]
b) A point is selected at random inside a circle. Find the probability that the point is closer to the center of the circle than its circumference. [4]
2. a) If 2% of the bulbs manufactured by a certain company are defective, find the probability that in a sample of 200 bulbs, i) less than 2 bulbs, iii) more than 3 bulbs are defective. [5]
b) Derive the expression for the mgf of Normal (μ, σ^2) distribution. [5]
3. a) Sketch the graph of i) *Reliability vs. time*, ii) *CDF of failure vs. time* iii) *pdf of failure vs. time*. [6]
b) What is the difference between *random failure* and *deterministic failure*? [4]
4. Given a linear hazard rate function $\lambda(t) = 4 \times 10^{-4}t$ where t is measured in operating hours, what is the design life if a reliability of 0.96 is required? What is the average failure rate from time 0 to 100 hours? [5+5]
5. a) Explain the term *hazard rate* in reliability. b) Show that the *hazard rate function (HRF)* uniquely determines the *reliability function*. [4+6]
6. The series-parallel system shown in figure below are made up of 10 components. The reliability of each component is also given in figure. Components 3,4 and 5 are not identical, and in this group at least one component must be available for system success. Component 8,9 and 10 are identical, and for this particular group it is necessary that two out of the three components function satisfactorily for system success. Evaluate the system reliability. [10]



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