Assignment - 2

RE 69004: Reliability Simulation Laboratory – Spring 2026

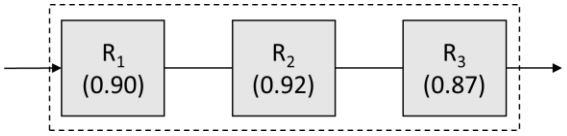
Subir Chowdhury School of Quality and Reliability, IIT Kharagpur

Q1: Reliability evaluation of series and parallel systems

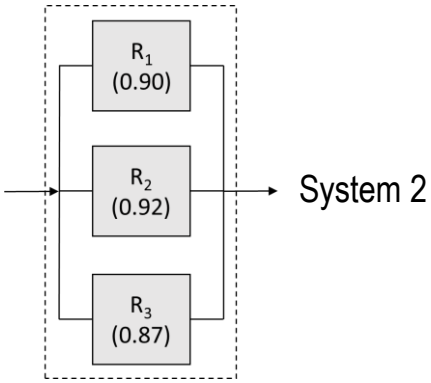
Two systems are each composed of three components. In the first system, the components are connected in series, while in the second system, the components are connected in parallel, as illustrated in the figures provided. The reliabilities of these components for a specified operational duration are 0.90, 0.92, and 0.87, respectively.

(a) Estimate the reliability of both systems using Monte Carlo simulation. Study the effect of sample size on the estimated system reliability by repeating the simulation for increasing sample sizes (e.g., $10^2, 10^3, 10^4, 10^5$). Plot the estimated reliability as a function of sample size.

(b) Compare the simulation-based estimates with the analytical results and comment on the convergence behavior and accuracy of the Monte Carlo method.



System 1



Q2: Reliability evaluation of a series-parallel system

The RBD of a system consisting of multiple subsystems is shown in the figure below. The reliabilities of the individual components for a specified operational duration are provided.

(a) Estimate the system reliability and subsystem reliabilities using Monte Carlo simulation, and compare the results with the corresponding analytical reliabilities.

(b) Identify the minimal cut sets of the system. Using the simulation outcomes, estimate the probability of occurrence of each minimal cut set and rank them from highest to lowest probability.