

Assignment - 3

RE 69004: Reliability Simulation Laboratory – Spring 2026

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Q1: Reliability analysis of a series-parallel system with exponential and Weibull component lifetimes

The reliability block diagram (RBD) of a system, consisting of a total of eight components, is shown in the figure below. The time to failure (TTF) of components in Subsystem 1 and Subsystem 2 follows an exponential distribution with failure rates $\lambda_1=0.001$ failures/hour (Subsystem 1) and $\lambda_2=0.0012$ failures/hour (Subsystem 2). The TTF of components in Subsystem 3 follows Weibull distribution with shape parameter $\beta=1.5$ and scale parameter $\theta=1000$ hours.

- Using Monte Carlo simulation, determine the reliabilities of the subsystems for 100, 500, and 1000 hours of operation. Verify the simulation results with analytically derived results. Identify the most critical subsystem.
- Using Monte Carlo simulation, determine the reliability of the system for 100, 500, and 1000 hours of operation. Verify the simulation results with analytically derived results.
- Determine the lifetime distribution of the system using failure times and represent it using a histogram.
- Model the system lifetime distribution using a Weibull lifetime model and estimate the distribution parameters using maximum likelihood estimation (MLE) method.

