CS60058 - problem set 1

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1. A duplex system consists of two active units and a comparator. Assume that each unit has a failure rate of λ and a repair rate of μ. The outputs of the two active units are compared and when a mismatch is detected, a procedure to locate the faulty unit is performed. The probability that upon a failure, the faulty unit is correctly identified and the fault-free unit (and consequently, the system) continues to run properly, is the coverage factor c. Note that when a coverage failure occurs, the entire system fails and both units have to be repaired (at a rate μ each). When the repair of one unit is complete, the system becomes operational and the repair of the second unit continues, allowing the system to return to its original state.

   - Show the Markov model for this duplex system. (5)
   - Derive an expression for the long-term availability of the system assuming that $\mu = 2\lambda$. (10)

2. Show that the MTTF of a parallel system of N modules, each of which suffer permanent failures at a rate λ is given by $\sum_{k=1}^{N} \frac{1}{k\lambda}$. (5)