1 Component Counting

Suppose there are N components. M of these are type 1, having distribution $F_1(t)$; N-M are of type 2, having failure distribution $F_2(t)$. Suppose that the system fails at time S when the k^{th} component (of either kind) fails. Write an equation for the CDF of S, $F_S(t)$.

2 Hazard Rate

Imagine a random variable X which is constructed by selecting from one of two distributions, with probability p of selecting type 1 with pdf $f_1(t)$ and cdf $F_1(t)$, and with probability (1-p) of selecting type 2 with pdf $f_2(t)$ and cdf $F_2(t)$. Give the hazard rate function for X.

3 Message Passing

A message needs to be delivered originating from point A, and arrive at point B. There are four ways this could be accomplished, and any one of them will suffice. Method 1 is by electric train. For the train to be operational there need to be power, the train needs to be in good repair, and there needs to be an operator available. Method 2 is by car. For the car to work, there needs to be an operational car and an available driver. Method 3 is by marathon runner, for which there must be an available marathon runner. Method 4 is by telegraph. For the telegraph to work, there must be an operational telegraph wire, power and an available telegraph operator. A marathon runner can drive a car, operate a train, and run the telegraph. A non-marathon operator can also drive a car, operate a train, and run the telegraph.

Imagine a system with components

- Electric train
- Power source
- Automobile
- Telegraph Wire
- Marathon runner
- Non-marathon running operator

Develop (a) a Reliability Block Diagram describing the ability to deliver the message, (b) a Fault Tree Diagram describing the failure conditions, and (c) a script for the RBD model that computes the probability that a connection fails by time t, as a function of t, for your choice of failure distributions for each component. Minimize the number of times a given component is represented in the RBD and Fault Tree.