

k Out of n Systems with Discrete Lifetimes

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Abstract

A k out of n system is a system consisting of n components which functions if and only if at least k of the components work. In this talk I will focus on the case when the components lifetimes are discrete random variables.

First, I will derive a closed-form formula describing the joint probability mass function of any subset of order statistics arising from discrete samples. This formula will be given in the most general case allowing dependence between not necessarily identically distributed variates in the sample. In the independent case it will be compactly rewritten by use of permanents.

Next, I will show how to apply the new formula to establish unconditional as well as some conditional probabilities of a failure of k out of n system. I will also establish two kinds of residual lifetimes of k out of n systems: the so-called usual residual lifetime and the residual lifetime at the system level.

Key words: k out of n systems, Order statistics, Discrete distributions, System residual lifetimes.