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Ordering and ageing properties of sequential order statistics governed by the Archimedean copula

In reliability theory, k-out-of-n systems play an important role as these are the basic structures of many technical systems used in real-life. While modeling these systems, we most often assumed that the failure of one component does not have any impact on the performance of the remaining surviving components. This indeed oversimplifies the modelling of such systems. Sequential order statistics are very useful tools for describing the lifetimes of components in a system in which the failure of one component may have severe consequences on the performance of the remaining surviving components. On the other hand, the lifetimes of components in a system are generally assumed to be independent. Being the complex nature of real-life systems, this assumption is not true in most of the scenarios. Copula is a frequently used technique to describe the dependency structure between components of a system. The family of Archimedian copulas is the most popular one among all existing copulas because it captures a wide range of dependency structures. In this study, we consider coherent systems with lifetimes represented by sequential order statistics where the dependence structure is described by the archimedean copula. To be more specifically, we consider the signature representation of a coherent system which is indeed a mixture representation. Using this, we study some stochastic comparisons results for coherent systems (formed by dependent components) with lifetimes described by sequential order statistics. In the process of development of these results, we also derive some ordering properties of sequential order statistics which may be useful in representing the lifetimes of k-out-of-n systems. In addition to this, some ageing properties (namely, ILR, IFR, IFRA, and NBU) of sequential order statistics have also been investigated.

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