Probability Models For Lifetime Data In Reliability And Survival Analysis

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The normal distribution is not a good fit for the analysis of nonnegative data such as arises in biological or medical settings, in waiting times, certain psychological processes. Although the normal distribution may be inappropriate, an appropriate alternative may not be obvious.
Three classes of alternatives that we study are nonparametric, semiparametric and parametric families. The origins of these distributions help to understand why these distributions were developed.
Properties that these distributions possess help to clarify when they might be used.
In particular, a number of types of parameters are discussed, and for each we consider several order relations: stochastic order, likelihood ratio order, hazard rate order, convex order.
The proos depend on convexity/concavity, total positivity; functional equations play a prominent role.
Historically the selection of models has been carried out in various ways. The early work of Pearson, Gram-Charlier, Edgeworth, Thiele suggested methods to choose densities that might fit different types of data.
Alternatively, properties or characterizations of distributions that are open to physical interpretations may help identify appropriate models or limit the candidates.
Characterizations and hazard rate behavior are often important.
It may come as a surprise (maybe not) that some of the trusted distributions come about as intersections of semiparametric models.