Book Reviews

Leadbetter, M.R., G. Lindgren, and H. Rootzen: Extremes and Related Properties of Random Sequences and Processes. Springer-Series in Statistics. Springer-Verlag, New York–Heidelberg–Berlin 1983, 336p., 28 figs., US \$ 36.00.

Since the book of E.J. Gumbel "Statistics of Extremes" (1958), which discusses the classical, about fifty years old theory of extreme values of independent, identically distributed random variables and the aspects of its applications to real situations, the theory of extreme values was continuously extended to include dependent sequences and later also continuous parameter stochastic processes. The early development was initiated by the work of G.S. Watson, S.M. Berman, R.M. Loynes and H. Cramér. In recent years the different directions of this development were unified in a general theory, including also the classical lines. Following this unification, the authors treat the general theory of extreme values, of mainly one-dimensional stochastic sequences and processes. They deal with the aspects of asymptotic distributional theory and the related properties, as the theory of exceedances and upcrossings of high levels, respectively downcrossings of low levels, and of extreme order statistics.

The book is split into four parts, each containing several chapters. Part I provides the classical extreme value theory of independent, identically distributed random variables. Furthermore it introduces, using elementary methods, the main ideas, which are the basis for the extension to the more general theory. The first extension to stationary sequences is discussed in the second part. Of main interest are dependent sequences, where the asymptotic distribution of the extreme values is the same as if the sequence of random variables were independent. In particular, normal (i.e. Gaussian) sequences are treated in a separate chapter by illuminating the general approach and extending it furthermore to strongly dependent and even to non-stationary cases. The related properties are also treated in detail, as the marginal and joint asymptotic distributions of the k -th extreme values, the independence of maxima in disjoint intervals, the exceedances of multiple levels, record times and extremal processes.

In the third part the extension of the theory to continuous parameter stationary stochastic processes is dealt with. Again the class of differentiable and non-differentiable normal processes is of main interest. This part uses extensively the concepts of level crossings and upcrossings. For its own right, it is treated in a separate chapter, since considerable information on the local structure of these stochastic processes is provided.

In the last part the authors discuss a few applications of the extreme value theory. Their aim is, not to provide examples which simply illustrate the application of the classical extreme value distributions for dependent processes, using routine fitting, but to demonstrate thoughtful case studies, using the underlying physical principles of the given problem. This part is a very valuable contribution to the methodology of extreme value applications.

An appendix is provided for readers who are not familiar with the theory of point processes. It includes the convergence of point processes, which is extensively used in some of the more specific sections on the point processes of exceedances or level crossings. But the main part of this lucidly written book is easily understood by readers who "have taken an introductory graduate probability course".

The book is a valuable contribution to the literature on the theory of extreme values, covering a great part of recent published and even unpublished papers and is recommended as well as a textbook for student courses as for scientists interested in this topic.

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