

Preface

Dear Reader, imagine that you are a participant of Olympic Games, say, you are one of n competitors in high-jumping. Before the start the future results of participants can be regarded as some independent random variables X_1, X_2, \dots, X_n . The competition will range all attempts of sportsmen and their final results can be considered as the observed values of the so-called order statistics $X_{1,n} \leq X_{2,n} \leq \dots \leq X_{n,n}$. Hence to predict the result of the winner you must know the distribution of the extreme order statistic $X_{n,n}$. The future destinations of the silver and bronze prizewinners are determined as $X_{n-1,n}$ and $X_{n-2,n}$ correspondingly. If you are a sprinter then the future results of the gold, silver and bronze medaled sportsmen are associated with minimal order statistics $X_{1,n}, X_{2,n}$, and $X_{3,n}$. These are the simplest examples of the “sport” applications of order statistics. Other examples of the applicability of order statistics (and especially of extreme order statistics) can be suggested by meteorologists, hydrologists, business analysts. The knowledge of the theory of order statistics is useful for specialists in the actuarial science and the reliability theory.

Some attempts to present a systematic exposition of the theory of order statistics and extremes began essentially from the publication of the David’s (1970) (the second issue of it appeared in 1981). We can mention also the following books, where the theory of order statistics and their different applications were presented: Galambos (1978, 1987), Arnold, Balakrishnan and Nagaraja (1992, 1998), Kamps (1995), Nevzorov (2000), Ahsanullah and Nevzorov (2001, 2005), David and Nagaraja (2003), Ahsanullah and Kirmani (2008). Almost all of these books are rather theoretical. We suggest here (see also Ahsanullah and Nevzorov (2005)) another way to study this theory. Together with the corresponding theoretical results, which are presented as 21 chapters, we suggest our readers to solve a lot of exercises. From one side it allows to understand better the main ideas and results of the theory. From other side the reader can determine his/her level of permeation to this material. Solutions of these exercises are given in the end of the corresponding chapters.

The aim of the book is to present various properties of the order statistics and inference based on them. The book is written on a lower technical level and requires elementary knowledge of algebra and statistics. The first chapter describes some basic definitions and properties of order statistics. Chapters 2 to 4 present sample quantiles, representation of order statistics as functions of independent and identically distributed random variables, conditional distributions and order statistics of discrete distributions. Chapters 5 to 11 give the moment properties and asymptotic behavior of middle, intermediate and extreme order statistics. Chapters 12 to 15 discuss estimation of parameters and their properties. Chapters 16 to 20 deal with order statistics from extended samples, record values, characterizations, order statistics from F-alpha distribution and generalized order statistics. Chapter 21 contains several interesting problems with hints to solve them.

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