Preface

Reliability theory has developed into a major discipline during the last six decades, thanks to the efforts of researchers from various subjects like mathematics,statistics, engineering, operations research, material science etc. At the same time, the ideas and concepts in reliability analysis have contributed to open new areas of study in several disciplines such as economics, actuarial science, medicine, biology, survival analysis, to mention a few. Technology has made tremendous progress in devising new products, devices and systems to the service of mankind for which the tools of reliability are indispensable to ensure their failure-free operation. During the early phase of the development of reliability theory and methods, discussions were mainly confined to continuous lifetimes with only occasional reference to discrete models. Though the trend on emphasis on continuous models still continues, the role of discrete models in lifetime studies is receiving much recognition in the last two decades. The fact that there are natural cases in which lifetimes emerge as a counting variable and also that there are situations in which discrete lifetimes are more appropriate than clock time when the latter is available, have made this shift appealing. Inspite of the growing interest in this field, a reference book exclusively for study and research in discrete reliability analysis does not appear to be available. The present monograph is an attempt to provide the material needed for a theoretical study of the concepts and results in modelling and analysis of reliability data in the discrete domain.

While writing this book we noticed that different kinds of definitions were used even in the basic notions concerning discrete lifetimes. We have presented the results in this connection under a uniform framework for easier understanding and application. Also there were no discrete analogues in literature for several important concepts and theorems in the continuous case: We have tried to include them to provide a continuity in the flow of discussions without gaps.

The book is organized into nine chapters. Chapter 1 deals with some basic tools in the form of definition and results that are required to develop the mathematical discussions in the subsequent chapters. This is followed by Chapter 2 in which the basic reliability functions and their properties are studied.

Various distributions that could be used as discrete lifetime models are presented in Chapter 3. The ageing concepts, the implications among them and the feature of classes of distributions based on them are discussed in Chapter 4. In Chapter 5 we consider non-monotonic ageing behaviour of the hazard rate and mean residual life along with models exhibiting such behaviour and their characteristics. Multivariate reliability functions form the material in Chapter 6. Various reliability functions in the univariate case in Chapter 2 are extended to the multivariate case in Chapter 7. Then we present in Chapter 8 some basic multivariate distributions which possess simple functional forms for the reliability functions. The concepts and methodology in reliability theory have contributed to open new areas of study in other disciplines. In Chapter 9, we review such contributions in survival analysis, economics, risk analysis, information theory, mathematics and statistics.

Many of the works reported in the book are analogues of the ideas and results in the continuous case proposed by various researchers. We could not make references to all such contributors due to limitations of space. Our sincere apologies to them as well as to those whose work do not find a place in this monograph. We whole-heartedly welcome all suggestions for improvements of the contents of this volume. Finally, we wish to thank Sanjay Varma and the Colleagues in the Department of Statistics of the Cochin University of Science and Technology for their invaluable contributions to our cause.

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