INTRODUCTION TO MEASURE AND INTEGRATION

BY

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PREFACE

There are many ways of developing the theory of measure and integration. In the present book measure is studied first as the primary concept and the integral is obtained later by extending its definition from the special case of 'simple' functions using monotone limits. The theory is presented for general measure spaces though at each stage Lebesgue measure and the Lebesgue integral in R^n are considered as the most important example, and the detailed properties are established for the Lebesgue case.

The book is designed for use either in the final undergraduate year at British universities or as a basic text in measure theory at the postgraduate level. Though the subject is developed as a branch of pure mathematics, it is presented in such a way that it has immediate application to any branch of applied mathematics which requires the basic theory of measure and integration as a foundation for its mathematical apparatus. In particular, our development of the subject is a suitable basis for modern probability theory – in fact this book first appeared as the initial section of the book *Introduction to measure and probability* (Cambridge University Press, 1966) written jointly with J. F. C. Kingman.

The book is largely self-contained. The first two chapters contain the essential parts of set theory and point set topology; these could well be omitted by a reader already familiar with these subjects. Chapters 3 and 4 develop the theory of measure by the usual process of extension from 'simple sets' to those of a larger class, and the properties of Lebesgue measure are obtained. The integral is defined in Chapter 5, again by extending its definition stage by stage, using monotone sequences. Chapter 6 includes a discussion of product measures and a definition of measure in function space. Convergence in function space is considered in Chapter 7, and Chapter 8 includes a treatment of complete orthonormal sets in Hilbert space. Chapter 9 deals with special spaces; differentiation theory for real functions of a real variable is developed and related to Lebesgue measure theory, and the Haar measure on a locally compact group is defined.

Starred sections contain more advanced material and can be omitted at a first reading.

It will be clear to any reader familiar with the standard treatises that this book owes much to what has gone before. I do not claim any particular originality for the treatment, but the form of presentation owes much to my experience of teaching this subject – at Birmingham

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University, Cornell University and the University of London – and I readily acknowledge the stimulus received from this source. I am grateful to Dr B. Fishel and Professor G. E. H. Reuter who made helpful criticisms of an early draft, and to a great number of students and colleagues who pointed out misprints and errors in the first edition. However my main debt of gratitude is to Professor J. F. C. Kingman who was co-author of the first edition of this book, and who was much involved in every detail of it.

S.J.T.

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