

<<测度与范畴学>>

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## 前言

This book has two main themes : the Baire category theorem as a method for proving existence, and the “ duality ” between measure and category. The category method is illustrated by a variety of typical applications , and the analogy between measure and category is explored in all of its ramifications. To this end, the elements of metric topology are reviewed and the principal properties of Lebesgue measure are derived. It turns out that Lebesgue integration is not essential for present purposes—the Riemann integral is sufficient. Concepts of general measure theory and topology are introduced , but not just for the sake of generality. Needless to say, the term “ category ” refers always to Baire category ; it has nothing to do with the term as it is used in homological algebra. A knowledge of calculus is presupposed, and some familiarity with the algebra of sets. The questions discussed are ones that lend themselves naturally to set-theoretical formulation. The book is intended as an introduction to this kind of analysis. It could be used to supplement a standard course in real analysis, as the basis for a seminar, or for independent study. It is primarily expository, but a few refinements of known results are included, notably Theorem 15.6 and Proposition 204. The references are not intended to be complete. Frequently a secondary source is cited where additional references may be found. The book is a revised and expanded version of notes originally prepared for a course of lectures given at Haverford College during the spring of 1957 under the auspices of the William Pyle Philips Fund. These , in turn , were based on the Earle Raymond Hedrick Lectures presented at the Summer Meeting of the Mathematical Association of America at Seattle, Washington, in August, 1956.

## 内容概要

This book has two main themes : the Baire category theorem as a method for proving existence, and the "duality" between measure and category. The category method is illustrated by a variety of typical applications, and the analogy between measure and category is explored in all of its ramifications. To this end, the elements of metric topology are reviewed and the principal properties of Lebesgue measure are derived. It turns out that Lebesgue integration is not essential for present purposes——the Riemann integral is sufficient. Concepts of general measure theory and topology are introduced, but not just for the sake of generality. Needless to say, the term "category" refers always to Baire category; it has nothing to do with the term as it is used in homological algebra

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## 书籍目录

1 . Measure and Category on the Line . , Countable sets, sets of first category , nullsets, the theorems of Cantor . Baire, and Borel 2 . Liouville Numbers . Algebraic and transcendental numbers, measure and category of the set of Liouville numbers 3 . Lebesgue Measure in  $r$ -Space . Definitions and principal properties , measurable sets , the Lebesgue density theorem 4 . The Property of Baire Its analogy to measurability , properties of regular open sets 5 . Non-Measurable Sets Vitali sets, Bernstein sets , Ulam ' s theorem, inaccessible cardinals, the continuum hypothesis 6 . The Banach-Mazur Game Winning strategies, category and local category, indeterminate games 7 . Functions of First Class . Oscillation, the limit of a sequence of continuous functions, Riemann integrability 8 . The Theorems of Lusin and Egoroff Continuity of measurable functions and of functions having the property of Baire, uniform convergence on subsets 9 . Metric and Topological Spaces Definitions, complete and topologically complete spaces, the Baire category theorem 10 . Examples of Metric Spaces Uniform and integral metrics in the space of continuous functions, integrable functions, pseudometric spaces , the space of measurable sets 11 . Nowhere Differentiable Functions Banach ' S application of the category method 12 . The Theorem of Alexandroff . Remetrization of a  $G$  . subset , topologically complete subspaces 13 . Transforming Linear Sets into Nullsets . The space of automorphisms of an interval . effect of monotone substitution on Riemann integrability . nullsets equivalent to sets of first category 14 . Fubini ' S Theorem Measurability and measure of sections of plane measurable sets 15 . The Kuratowski . Ulam Theorem . , Sections of plane sets having the property of Baire . product sets , reducibility of Fubini ' s theorem by means of a product transformation 16 . The Banach Category Theorem . Open sets of first category or measure zero, Montgomery ' S lemma , the theorems of Marczewski and Sikorski . cardinals of measure zero decomposition into a nullset and a set of first category 17 . The Poincaré Recurrence Theorem Measure and category of the set of points recurrent under a nondissipative transformation , application to dynamical systems 18 . Transitive Transformations Existence of transitive automorphisms of the square, the category method 19 . The Sierpinski - Erdős Duality Theorem . Similarities between the classes of sets of measure zero and of first category , the principle of duality 20 . Examples of Duality . Properties of Lusin sets and their duals , sets almost invariant under transformations that preserve nullsets or category 21 . The Extended Principle of Duality . A counter example . product measures and product spaces , the zero-one law and its category analogue 22 . Category Measure Spaces Spaces in which measure and category agree , topologies generated by low densities, the Lebesgue density topology Supplementary Notes and Remarks . References Supplementary References . Index

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