

An Introduction To Categorical Data Analysis

An Introduction To Categorical Data Analysis An to Categorical Data Analysis Understanding the World in Categories Categorical Data Qualitative Data ChiSquare Test Fishers Exact Test Logistic Regression Odds Ratio Contingency Table Data Visualization Categorical data analysis is a powerful tool used to explore and understand relationships within data categorized into distinct groups This blog post provides an introduction to this essential field covering its core concepts techniques and applications Well explore the key methodologies used for analyzing categorical data discuss its role in contemporary research and delve into the ethical considerations that come with its application The world is brimming with information and a significant portion of this information comes in the form of categories We encounter categorical data every day from the colors of cars on the road to the opinions of our friends on social media Categorical data also known as qualitative data describes attributes or characteristics that fall into distinct categories These categories are often descriptive like male or female yes or no or red or blue Analyzing categorical data helps us understand patterns relationships and trends within these groups Whether youre a researcher examining consumer preferences a marketer analyzing customer demographics or a social scientist studying voting patterns categorical data analysis is an essential tool for drawing insightful conclusions Exploring the Realm of Categorical Data Categorical data analysis is the process of examining and interpreting data that has been organized into distinct categories Unlike numerical data which measures quantities categorical data focuses on qualities and characteristics Lets take a closer look at some common types of categorical data Nominal Data This type of data represents categories without any inherent order Think of colors like red blue or green or types of music like rock pop or classical Ordinal Data This data type involves categories with a natural order but the differences between categories are not necessarily equal Examples include educational levels high school college doctorate or customer satisfaction ratings very unsatisfied unsatisfied neutral satisfied very satisfied 2 Binary Data This data type only has two categories often represented as yes or no true or false or 0 or 1 An example is whether a customer made a purchase or not Key Techniques for Analyzing Categorical Data Several statistical techniques are specifically designed to analyze categorical data Understanding these methods empowers you to extract meaningful insights from your data ChiSquare Test This test

is used to determine whether there is a significant association between two categorical variables. It compares the observed frequencies in a contingency table (a table that summarizes the frequencies of two or more categorical variables) to the expected frequencies under the assumption of independence.

Fishers Exact Test This test is a more accurate alternative to the ChiSquare test when dealing with small sample sizes or when the expected frequencies are low. It directly calculates the probability of observing the observed frequencies in the contingency table given that the variables are independent.

Logistic Regression This statistical method predicts the probability of a binary outcome (eg yes/no purchase) based on one or more predictor variables which can be categorical or numerical. It is widely used in fields like marketing, finance, and healthcare.

Odds Ratio This measure quantifies the strength of association between two categorical variables. It represents the ratio of the odds of an event occurring in one group to the odds of it occurring in another group. For example, it could be used to assess the risk of developing a certain disease in smokers compared to nonsmokers.

Data Visualization: Bringing Categorical Data to Life Data visualization plays a crucial role in effectively communicating the insights derived from categorical data analysis. Visual representations can make complex relationships easy to understand and can reveal patterns that might be missed in numerical summaries.

Some popular visualizations for categorical data include:

- Bar charts** Effectively display the frequency or proportion of different categories.
- Pie charts** Visually represent the distribution of proportions within a single categorical variable.
- Mosaic plots** Illustrate the relationship between two or more categorical variables by partitioning a square into smaller rectangles that represent the observed frequencies in each category.

Analysis of Current Trends in Categorical Data Analysis The field of categorical data analysis is constantly evolving, driven by advancements in computing power and the availability of increasingly large datasets. Some of the current trends include:

- Big Data and Machine Learning** With the explosion of big data, machine learning algorithms are being increasingly employed to analyze categorical data. Techniques like decision trees, support vector machines, and deep learning models are being used to predict outcomes and uncover complex relationships within vast datasets.
- Natural Language Processing (NLP)** Analyzing text data (eg social media posts, reviews, news articles) is becoming increasingly crucial for understanding sentiment, opinions, and trends. NLP techniques are being used to categorize and analyze textual data, enriching our understanding of human language.
- Causal Inference** Researchers are striving to move beyond simply identifying associations to establish causal relationships between categorical variables. Methods like randomized controlled trials and propensity score matching are being used to control for confounding variables and draw stronger causal

conclusions Ethical Considerations in Categorical Data Analysis As with any data analysis technique it is crucial to address ethical considerations when working with categorical data These considerations include Data Privacy Protecting the privacy of individuals is paramount Data anonymization techniques secure data storage practices and adherence to relevant privacy regulations are essential Data Bias Categorical data is often susceptible to bias which can lead to inaccurate or misleading conclusions Understanding potential sources of bias such as sampling bias or measurement bias is crucial for ensuring the validity of the analysis Fairness and Equity The use of categorical data analysis should promote fairness and equity Be mindful of how data is used to make decisions particularly in contexts where discrimination or bias could occur Conclusion Categorical data analysis is a versatile and powerful tool for understanding the world around us From market research to scientific discovery it provides us with insights that can shape our understanding of human behavior social trends and scientific phenomena As technology continues to advance and data becomes increasingly ubiquitous mastering categorical data analysis will become increasingly important for anyone seeking to make informed decisions and contribute to a more datadriven future 4

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praise for the second edition a must have book for anyone expecting to do research and or applications in categorical data analysis statistics in medicine it is a total delight reading this book pharmaceutical research if you do any analysis of categorical data this is an essential desktop reference technometrics the use of statistical methods for analyzing categorical data has increased dramatically particularly in the biomedical social sciences and financial industries responding to new developments this book offers a comprehensive treatment of the most important methods for categorical data analysis categorical data analysis third edition summarizes the latest methods for univariate and correlated multivariate categorical responses readers will find a unified generalized linear models approach that connects logistic regression and poisson and negative binomial loglinear models for discrete data with normal regression for continuous data this edition also features an emphasis on logistic and probit regression methods for binary ordinal and nominal responses for independent observations and for clustered data with marginal models and random effects models two new chapters on alternative methods for binary response data including smoothing and regularization methods classification methods such as linear discriminant analysis and classification trees and cluster analysis new sections introducing the bayesian approach for methods in that chapter more than 100 analyses of data sets and over 600 exercises notes at the end of each chapter that provide references to recent research and topics not covered in the text linked to a bibliography of more than 1 200 sources a supplementary website showing how to use r and sas for all examples in the text with information also about spss and stata and with exercise solutions categorical data analysis third edition is an invaluable tool for statisticians and methodologists such as biostatisticians and researchers in the social and behavioral sciences medicine and public health marketing education finance biological and agricultural sciences and industrial quality control

statisticians and researchers will find this book newly updated for sas stat 12.1 to be a useful discussion of categorical data analysis techniques as well as an invaluable aid in applying these methods with sas

categorical data comprising counts of individuals objects or entities in different categories emerge frequently from many areas of study including medicine sociology geology and education they provide important statistical information that can lead to real life conclusions and the discovery of fresh knowledge therefore the ability to manipulate understand and interpret categorical data becomes of interest if not essential to professionals and students in a broad range of disciplines although t tests linear regression and analysis of variance are useful valid methods for analysis of measurement data categorical data requires a different methodology and techniques typically not encountered in introductory statistics courses developed from long experience in teaching categorical analysis to a multidisciplinary mix of undergraduate and graduate students a course in categorical data analysis presents the easiest most straightforward ways of extracting real life conclusions from contingency tables the author uses a fisherian approach to categorical data analysis and incorporates numerous examples and real data sets although he offers s plus routines through the internet readers do not need full knowledge of a statistical software package in this unique text the author chooses methods and an approach that nurtures intuitive thinking he trains his readers to focus not on finding a model that fits the data but on using different models that may lead to meaningful conclusions the book offers some simple innovative techniques not highlighted in other texts that help make the book accessible to a broad interdisciplinary audience a course in categorical data analysis enables readers to quickly use its offering of tools for drawing scientific medical or real life conclusions from categorical data sets

this book provides a comprehensive introduction to methods and models for categorical data analysis and their applications in social science research companion website also available at webSPACE.utexas.edu/dpowers

a valuable new edition of a standard reference the use of statistical methods for categorical data has increased dramatically particularly for applications in the biomedical and social sciences an introduction to categorical data analysis third edition summarizes these methods and shows readers how to use them using software readers will find a unified generalized linear models approach that connects logistic regression and loglinear models for discrete data with normal regression for continuous data adding to the value in the new edition is illustrations

of the use of r software to perform all the analyses in the book a new chapter on alternative methods for categorical data including smoothing and regularization methods such as the lasso classification methods such as linear discriminant analysis and classification trees and cluster analysis new sections in many chapters introducing the bayesian approach for the methods of that chapter more than 70 analyses of data sets to illustrate application of the methods and about 200 exercises many containing other data sets an appendix showing how to use sas stata and spss and an appendix with short solutions to most odd numbered exercises written in an applied nontechnical style this book illustrates the methods using a wide variety of real data including medical clinical trials environmental questions drug use by teenagers horseshoe crab mating basketball shooting correlates of happiness and much more an introduction to categorical data analysis third edition is an invaluable tool for statisticians and biostatisticians as well as methodologists in the social and behavioral sciences medicine and public health marketing education and the biological and agricultural sciences

amstat news asked three review editors to rate their top five favorite books in the september 2003 issue categorical data analysis was among those chosen a valuable new edition of a standard reference a must have book for anyone expecting to do research and or applications in categorical data analysis statistics in medicine on categorical data analysis first edition the use of statistical methods for categorical data has increased dramatically particularly for applications in the biomedical and social sciences responding to new developments in the field as well as to the needs of a new generation of professionals and students this new edition of the classic categorical data analysis offers a comprehensive introduction to the most important methods for categorical data analysis designed for statisticians and biostatisticians as well as scientists and graduate students practicing statistics categorical data analysis second edition summarizes the latest methods for univariate and correlated multivariate categorical responses readers will find a unified generalized linear models approach that connects logistic regression and poisson and negative binomial regression for discrete data with normal regression for continuous data adding to the value in the new edition is coverage of three new chapters on methods for repeated measurement and other forms of clustered categorical data including marginal models and associated generalized estimating equations gee methods and mixed models with random effects stronger emphasis on logistic regression modeling of binary and multicategory data an appendix showing the use of sas for conducting nearly all analyses in the book prescriptions for how ordinal variables should be treated differently than nominal variables discussion of exact small sample procedures more than 100 analyses of real data sets to

illustrate application of the methods and more than 600 exercises an instructor's manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department

analysis of categorical data with R second edition presents a modern account of categorical data analysis using the R software environment it covers recent techniques of model building and assessment for binary multicategory and count response variables and discusses fundamentals such as odds ratio and probability estimation the authors give detailed advice and guidelines on which procedures to use and why to use them the second edition is a substantial update of the first based on the authors' experiences of teaching from the book for nearly a decade the book is organized as before but with new content throughout and there are two new substantive topics in the advanced topics chapter group testing and splines the computing has been completely updated with the emmeans package now integrated into the book the examples have also been updated notably to include new examples based on COVID-19 and there are more than 90 new exercises in the book the solutions manual and teaching videos have also been updated features requires no prior experience with R and offers an introduction to the essential features and functions of R includes numerous examples from medicine psychology sports ecology and many other areas integrates extensive R code and output graphically demonstrates many of the features and properties of various analysis methods offers a substantial number of exercises in all chapters enabling use as a course text or for self study supplemented by a website with data sets code and teaching videos analysis of categorical data with R second edition is primarily designed for a course on categorical data analysis taught at the advanced undergraduate or graduate level such a course could be taught in a statistics or biostatistics department or within mathematics psychology social science ecology or another quantitative discipline it could also be used by a self learner and would make an ideal reference for a researcher from any discipline where categorical data arise

the past quarter century has seen an explosion in the development of methods for analyzing categorical data these methods have influenced and been influenced by the increasing availability of multivariate data sets with categorical responses in the social behavioral and biomedical sciences as well as in public health ecology education marketing food science and industrial quality control categorical data analysis describes the most important new methods offering a unified presentation of modeling using generalized linear models and emphasizing

loglinear and logit modeling techniques contributions of noted statisticians pearson yule fisher neyman cochrane whose pioneering efforts set the pace for the evolution of modern methods are examined as well special features of the book include coverage of methods for repeated measurement data which have become increasingly important in biomedical applications prescriptions for how ordinal variables should be treated differently than nominal variables derivations of basic asymptotic and fixed sample size inferential methods discussion of exact small sample procedures more than 40 examples of analyses of real data sets including aspirin use and heart disease job satisfaction and income seat belt use and injuries in auto accidents and predicting outcomes of baseball games more than 400 exercises to facilitate interpretation and application of methods categorical data analysis also contains an appendix that describes the use of computer software currently available for performing the analyses presented in the book a comprehensive bibliography and notes at the end of each chapter round out the work making it a complete invaluable reference for statisticians biostatisticians and professional researchers

introduces the key concepts in the analysis of categorical data with illustrative examples and accompanying r code this book is aimed at all those who wish to discover how to analyze categorical data without getting immersed in complicated mathematics and without needing to wade through a large amount of prose it is aimed at researchers with their own data ready to be analyzed and at students who would like an approachable alternative view of the subject each new topic in categorical data analysis is illustrated with an example that readers can apply to their own sets of data in many cases r code is given and excerpts from the resulting output are presented in the context of log linear models for cross tabulations two specialties of the house have been included the use of cobweb diagrams to get visual information concerning significant interactions and a procedure for detecting outlier category combinations the r code used for these is available and may be freely adapted in addition this book uses an example to illustrate each new topic in categorical data provides a clear explanation of an important subject is understandable to most readers with minimal statistical and mathematical backgrounds contains examples that are accompanied by r code and resulting output includes starred sections that provide more background details for interested readers categorical data analysis by example is a reference for students in statistics and researchers in other disciplines especially the social sciences who use categorical data this book is also a reference for practitioners in market research medicine and other fields

statistical science's first coordinated manual of methods for analyzing ordered categorical data now fully revised and updated continues to present applications and case studies in fields as diverse as sociology public health ecology marketing and pharmacy analysis of ordinal categorical data second edition provides an introduction to basic descriptive and inferential methods for categorical data giving thorough coverage of new developments and recent methods special emphasis is placed on interpretation and application of methods including an integrated comparison of the available strategies for analyzing ordinal data practitioners of statistics in government industry particularly pharmaceutical and academia will want this new edition

until recent years the statistical and computational techniques available for the analysis of cross classified data were quite limited this book presents some of the recent work on the statistical analysis of cross classified data using longlinear models

an applied treatment of modern graphical methods for analyzing categorical data discrete data analysis with r visualization and modeling techniques for categorical and count data presents an applied treatment of modern methods for the analysis of categorical data both discrete response data and frequency data it explains how to use graphical meth

an updated treatment of categorical data analysis in the biomedical sciences that now explores applications to translational research thoroughly updated with the latest advances in the field applied categorical data analysis and translational research second edition maintains the accessible style of its predecessor while also exploring the importance of translational research as it relates to basic scientific findings within clinical practice with its easy to follow style updated coverage of major methodologies and broadened scope of coverage this new edition provides an accessible guide to statistical methods involving categorical data and the steps to their application in problem solving in the biomedical sciences delving even further into the applied direction this update offers many real world examples from biomedicine epidemiology and public health along with detailed case studies taken straight from modern research in these fields additional features of the second edition include a new chapter on the relationship between translational research and categorical data focusing on design study bioassay and phase i and phase ii clinical trials a new chapter on categorical data and diagnostic medicine with coverage of the diagnostic process prevalence surveys the roc function and roc curve and important statistical considerations a revised chapter on logistic regression models featuring an updated treatment of simple and multiple regression analysis an added section on quantal

bioassays each chapter features updated and new exercise sets along with numerous graphs that demonstrate the highly visual nature of the topic a related site features the book's examples as well as additional data sets that can be worked with using sas software the only book of its kind to provide balanced coverage of methods for both categorical data and translational research applied categorical data analysis and translational research second edition is an excellent book for courses on applied statistics and biostatistics at the upper undergraduate and graduate levels it is also a valuable reference for researchers and practitioners in the biomedical and public health fields

categorical data arise often in many fields including biometrics economics management manufacturing marketing psychology and sociology this book provides an introduction to the analysis of such data the coverage is broad using the loglinear poisson regression model and logistic binomial regression models as the primary engines for methodology topics covered include count regression models such as poisson negative binomial zero inflated and zero truncated models loglinear models for two dimensional and multidimensional contingency tables including for square tables and tables with ordered categories and regression models for two category binary and multiple category target variables such as logistic and proportional odds models all methods are illustrated with analyses of real data examples many from recent subject area journal articles these analyses are highlighted in the text and are more detailed than is typical providing discussion of the context and background of the problem model checking and scientific implications more than 200 exercises are provided many also based on recent subject area literature data sets and computer code are available at a web site devoted to the text adopters of this book may request a solutions manual from textbook springer ny com from the reviews jeff simonoff's book is at the top of the heap of categorical data analysis textbooks the examples are superb student reactions in a class i taught from this text were uniformly positive particularly because of the examples and exercises additional materials related to the book particularly code for s plus sas and r useful for analysis of examples can be found at the author's site at new york university i liked this book for this reason and recommend it to you for pedagogical purposes stanley wasserman the american statistician august 2006 vol 60 no 3 the book has various noteworthy features the examples used are from a variety of topics including medicine economics sports mining weather as well as social aspects like needle exchange programs the examples motivate the theory and also illustrate nuances of data analytical procedures the book also incorporates several newer methods for analyzing categorical data including zero inflated poisson models robust analysis of binomial

and poisson models sandwich estimators multinomial smoothing ordinal agreement tables this is definitely a good reference book for any researcher working with categorical data technometrics may 2004 this guide provides a practical approach to the appropriate analysis of categorical data and would be a suitable purchase for individuals with varying levels of statistical understanding paediatric and perinatal epidemiology 2004 18 this book gives a fresh approach to the topic of categorical data analysis the presentation of the statistical methods exploits the connection to regression modeling with a focus on practical features rather than formal theory there is much to learn from this book aside from the ordinary materials such as association diagrams mantel haenszel estimators or overdispersion the reader will also find some less often presented but interesting and stimulating topics t his is an excellent book giving an up to date introduction to the wide field of analyzing categorical data biometrics september 2004 it is of great help to data analysts practitioners and researchers who deal with categorical data and need to get a necessary insight into the methods of analysis as well as practical guidelines for solving problems international journal of general systems august 2004 the author has succeeded in writing a useful and readable textbook combining most of general theory and practice of count data kwantitatieve methoden the book especially stresses how to analyze and interpret data in fact the highly detailed multi page descriptions of analysis and interpretation make the book stand out mathematical geology february 2005 overall this is a competent and detailed text that i would recommend to anyone dealing with the analysis of categorical data journal of the royal statistical society this important work allows for clear analogies between the well known linear models for gaussian data and categorical data problems jeffrey simonoff s analyzing categorical data provides an introduction to many of the important ideas and methods for understanding counted data and tables of counts some readers will find simonoff s style very much to their liking due to reliance on extended real data examples to illuminate ideas i think the extensive examples will appeal to most students sanford weisberg siam review vol 47 4 2005 it is clear that the focus of simonoff s book is different from other books on categorical data analysis as an introductory textbook the book is comprehensive enough since all basic topics in categorical data analysis are discussed i think simonoff s book is a valuable addition to the literature because it discusses important models for counts jeroen k vermont statistics in medicine vol 24 2005 the author based this book on his notes for a class with a very diverse pool of students the material is presented in such a way that a very heterogeneous group of students could grasp it all methods are illustrated with analyses of real data examples the author provides a detailed discussion of the context and background of the problem the book is very interesting and can be warmly recommended to

people working with categorical data ems european mathematical society newsletter december 2004 categorical data arise often in many fields this book provides an introduction to the analysis of such data all methods are illustrated with analyses of real data examples many from recent subject area journal articles these analyses are highlighted in the text and are more detailed than is typical more than 200 exercises are provided including many based on recent subject area literature data sets and computer code are available at a site devoted to this text t postelnicu zentralblatt math vol 1028 2003 this book grew out of notes prepared by the author for classes in categorical data analysis the presentation is fresh and compelling to read regression ideas are used to motivate the modelling presented the book focuses on applying methods to real problems many of these will be novel to readers of statistics texts all chapters end with a section providing references to books or articles for the inquiring reader c m o brien short book reviews vol 23 3 2003

the aim of this book is to give an up to date account of the most commonly uses statisti cal models for categorical data the emphasis is on the connection between theory and applications to real data sets the book only covers models for categorical data various models for mixed continuous and categorical data are thus excluded the book is written as a textbook although many methods and results are quite recent this should imply that the book can be used for a graduate course in categorical data analysis with this aim in mind chapters 3 to 12 are concluded with a set of exer cises in many cases the data sets are those data sets which were not included in the examples of the book although they at one point in time were regarded as potential can didates for an example a certain amount of general knowledge of statistical theory is necessary to fully benefit from the book a summary of the basic statistical concepts deemed necessary pre requisites is given in chapter 2 the mathematical level is only moderately high but the account in chapter 3 of basic properties of exponential families and the parametric multinomial distribution is made as mathematical precise as possible without going into mathematical details and leaving out most proofs

featuring a practical approach with numerous examples this book focuses on helping the reader develop a conceptual rather than technical understanding of categorical methods making it a much more accessible text than others on the market the authors cover common categorical analyses and emphasize specific research questions that can be addressed by each analytic procedure so that readers are able to address the research questions they wish to answer to achieve this goal the authors review the theoretical implications and assumptions

underlying each of the procedures present each concept in general terms and illustrate each with a practical example demonstrate the analyses using spss and sas and show the interpretation of the results provided by these programs a look ahead section at the beginning of each chapter provides an overview of the material covered so that the reader knows what to expect this is followed by one or more research questions that can be addressed using the procedure s covered in the chapter a theoretical presentation of the material is provided and illustrated using realistic examples from the behavioral and social sciences to further enhance accessibility the new procedures introduced in the book are explicitly related to analytic procedures covered in earlier statistics courses such as anova and linear regression throughout each chapter the authors use practical examples to demonstrate how to obtain and interpret statistical output in both spss and sas their emphasis on the relationship between the initial research question the use of the software to carry out the analysis and the interpretation of the output as it relates to the initial research question allows readers to easily apply the material to their own research the data sets for executing chapter examples using sas version 9 1 3 and or ibm spss version 18 are available on a book specific web site these data sets and syntax allow readers to quickly run the programs and obtain the appropriate output the book also includes both conceptual and analytic end of chapter exercises to assist instructors and students in evaluating the understanding of the material covered in each chapter this book covers the most commonly used categorical data analysis procedures it is written for those without an extensive mathematical background and is ideal for graduate courses in categorical data analysis or cross classified data analysis taught in departments of psychology human development family studies sociology education and business researchers in these disciplines interested in applying these procedures to their own research will appreciate this book s accessible approach

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categorical data analysis and multilevel modeling using r provides a practical guide to regression techniques for analyzing binary ordinal nominal and count response variables using the r software author xing liu offers a unified framework for both single level and multilevel modeling of categorical and count response variables with both frequentist and bayesian approaches each chapter demonstrates how to conduct the analysis using r how to interpret the models and how to present the results for publication a companion website for this book contains datasets and r commands used in the book for students and solutions for the end of chapter exercises on the instructor site

praise for the first edition this is a superb text from which to teach categorical data analysis at a variety of levels this book can be very highly recommended short book reviews of great interest to potential readers is the variety of fields that are represented in the examples health care financial government product marketing and sports to name a few journal of quality technology alan agresti has written another brilliant account of the analysis of categorical data the statistician the use of statistical methods for categorical data is ever increasing in today's world an introduction to categorical data analysis second edition provides an applied introduction to the most important methods for analyzing categorical data this new edition summarizes methods that have long played a prominent role in data analysis such as chi squared tests and also places special emphasis on logistic regression and other modeling techniques for univariate and correlated multivariate categorical responses this second edition features two new chapters on the methods for clustered data with an emphasis on generalized estimating equations gee and random effects models a unified perspective based on generalized linear models an emphasis on logistic regression modeling an appendix that demonstrates the use of sas r for all methods an entertaining historical perspective on the

development of the methods specialized methods for ordinal data small samples multicategory data and matched pairs more than 100 analyses of real data sets and nearly 300 exercises written in an applied nontechnical style the book illustrates methods using a wide variety of real data including medical clinical trials drug use by teenagers basketball shooting horseshoe crab mating environmental opinions correlates of happiness and much more an introduction to categorical data analysis second edition is an invaluable tool for social behavioral and biomedical scientists as well as researchers in public health marketing education biological and agricultural sciences and industrial quality control

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Introduction

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