Multiple Comparison Procedures

- What happens if we reject the null hypothesis?
    - Conclude that the population means are not all equal
    - Do not know whether all of the means are different from one another or if only some of them are different
- Want to conduct additional tests to find out where the differences lie
- Number of multiple comparison tests available, each with advantages and disadvantages
- Simple approach is to perform a series of two sample t-tests
    - This increases the probability of committing a Type I error
    - Avoid this problem by reducing the individual α levels to ensure that the overall level of significance is kept at a predetermined level

Multiple Comparison Procedures

Peipei Pang

Multiple Comparison Procedures:

   Multiple Comparison Procedures Larry E. Toothaker,1993 If you conduct research with more than two groups and want to find out if they are significantly different when compared two at a time then you need Multiple Comparison Procedures Using examples to illustrate major concepts this concise volume is your guide to multiple comparisons Toothaker thoroughly explains such essential issues as planned vs post hoc comparisons stepwise vs simultaneous test procedures types of error rate unequal sample sizes and variances and interaction tests vs cell mean tests   **Multiple Comparison Procedures** Yosef Hochberg,Ajit C. Tamhane,1987-10-05 Offering a balanced up to date view of multiple comparison procedures this book refutes the belief held by some statisticians that such procedures have no place in data analysis With equal emphasis on theory and applications it establishes the advantages of multiple comparison techniques in reducing error rates and in ensuring the validity of statistical inferences Provides detailed descriptions of the derivation and implementation of a variety of procedures paying particular attention to classical approaches and confidence estimation procedures Also discusses the benefits and drawbacks of other methods Numerous examples and tables for implementing procedures are included making this work both practical and informative   *Recent Developments in Multiple Comparison Procedures* Yoav Benjamini,Frank Bretz,Sanat K. Sarkar,2004   Multiple Comparisons Using R Frank Bretz,Torsten Hothorn,Peter Westfall,2016-04-19 Adopting a unifying theme based on maximum statistics Multiple Comparisons Using R describes the common underlying theory of multiple comparison procedures through numerous examples It also presents a detailed description of available software implementations in R The R packages and source code for the analyses are available at http CRAN R pro   *Handbook of Multiple Comparisons* Xinping Cui,Thorsten Dickhaus,Ying Ding,Jason C. Hsu,2021-11-17 Written by experts that include originators of some key ideas chapters in the Handbook of Multiple Testing cover multiple comparison problems big and small with guidance toward error rate control and insights on how principles developed earlier can be applied to current and emerging problems Some highlights of the coverages are as follows Error rate control is useful for controlling the incorrect decision rate Chapter 1 introduces Tukey s original multiple comparison error rates and point to how they have been applied and adapted to modern multiple comparison problems as discussed in the later chapters Principles endure While the closed testing principle is more familiar Chapter 4 shows the partitioning principle can derive confidence sets for multiple tests which may become important as the profession goes beyond making decisions based on p values Multiple comparisons of treatment efficacy often involve multiple doses and endpoints Chapter 12 on multiple endpoints explains how different choices of endpoint types lead to different multiplicity adjustment strategies while Chapter 11 on the MCP Mod approach is particularly useful for dose finding To assess efficacy in clinical trials with multiple doses and multiple endpoints the reader can see the traditional approach in Chapter 2 the Graphical approach in Chapter 5 and the multivariate approach in Chapter 3 Personalized precision medicine based on targeted therapies already a reality naturally

leads to analysis of efficacy in subgroups Chapter 13 draws attention to subtle logical issues in inferences on subgroups and their mixtures with a principled solution that resolves these issues This chapter has implication toward meeting the ICHE9R1 Estimands requirement Besides the mere multiple testing methodology itself the handbook also covers related topics like the statistical task of model selection in Chapter 7 or the estimation of the proportion of true null hypotheses or in other words the signal prevalence in Chapter 8 It also contains decision theoretic considerations regarding the admissibility of multiple tests in Chapter 6 The issue of selected inference is addressed in Chapter 9 Comparison of responses can involve millions of voxels in medical imaging or SNPs in genome wide association studies GWAS Chapter 14 and Chapter 15 provide state of the art methods for large scale simultaneous inference in these settings *Pairwise Multiple Comparisons* Taka-aki Shiraishi,Hiroshi Sugiura,Shin-ichi Matsuda,2019-09-30 This book focuses on all pairwise multiple comparisons of means in multi sample models introducing closed testing procedures based on maximum absolute values of some two sample t test statistics and on F test statistics in homoscedastic multi sample models It shows that 1 the multi step procedures are more powerful than single step procedures and the Ryan Einot Gabriel Welsh tests and 2 the confidence regions induced by the multi step procedures are equivalent to simultaneous confidence intervals Next it describes the multi step test procedure in heteroscedastic multi sample models which is superior to the single step Games Howell procedure In the context of simple ordered restrictions of means the authors also discuss closed testing procedures based on maximum values of two sample one sided t test statistics and based on Bartholomew s statistics Furthermore the book presents distribution free procedures and describes simulation studies performed under the null hypothesis and some alternative hypotheses Although single step multiple comparison procedures are generally used the closed testing procedures described are more powerful than the single step procedures In order to execute the multiple comparison procedures the upper 100 percentiles of the complicated distributions are required Classical integral formulas such as Simpson s rule and the Gaussian rule have been used for the calculation of the integral transform that appears in statistical calculations However these formulas are not effective for the complicated distribution As such the authors introduce the sinc method which is optimal in terms of accuracy and computational cost *Multiple Comparisons for Researchers* Larry E. Toothaker,1991-08-27 Through clear exposition and step by step procedures Toothaker describes all the most important multiple comparison procedures along with relevant concepts such as error rate power robustness and coverage of two way ANOVA including the controversy on cell mean versus tests on interaction effects The book also includes samples of multiple comparison programs in SAS and SPSS *Multiple Comparison Procedures* ,2007 **Multiple Comparison Procedures Based on Gaps** Roy E. Welsch,2015-09-11 This work has been selected by scholars as being culturally important and is part of the knowledge base of civilization as we know it This work was reproduced from the original artifact and remains as true to the original work as possible Therefore you will see the original copyright references library stamps as most of these works have been housed in our most important libraries

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to skip to the information you need without having to read previous chapters With Intermediate Statistics For Dummies you ll have all the tools you need to make important decisions in all types of professional areas from biology and engineering to business and politics *Multiple Comparisons for Bernoulli Data* Taka-aki Shiraishi,2022-05-31 This book focuses on multiple comparisons of proportions in multi sample models with Bernoulli responses First the author explains the one sample and two sample methods that form the basis of multiple comparisons Then regularity conditions are stated in detail Simultaneous inference for all proportions based on exact confidence limits and based on asymptotic theory is discussed Closed testing procedures based on some one sample statistics are introduced For all pairwise multiple comparisons of proportions the author uses arcsine square root transformation of sample means Closed testing procedures based on maximum absolute values of some two sample test statistics and based on chi square test statistics are introduced It is shown that the multi step procedures are more powerful than single step procedures and the Ryan Einot Gabriel Welsch REGW type tests Furthermore the author discusses multiple comparisons with a control Under simple ordered restrictions of proportions the author also discusses closed testing procedures based on maximum values of two sample test statistics and based on Bartholomew s statistics Last serial gatekeeping procedures based on the above mentioned closed testing procedures are proposed although Bonferroni inequalities are used in serial gatekeeping procedures of many A Practical Guide to the Multiple Comparison Procedures Hea Sook Kim,1985 *Introduction to Multiple Comparison Procedures* ,1979

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