

Department of: Statistics& Informatics

College of: Administration and Economics.

University of: Salahaddin-Hawler.

Subject: Linear and Non-Linear Models

Course Book: PhD Stage

*First Semester*

Lecturer's name: Prof. Dr Taha Hussein Ali

Academic Year: 2023 - 2024

**Course Book**

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| 1. Course name | Linear and Non-Linear Models |
| 2. Lecturer in charge | Dr Taha Hussein Ali |
| 3. Department/ College | Department of Statistics and Informative / College of Administration and Economics. |
| 4. Contact | e-mail: **taha.ali@su.edu.krd** |
| 5. Time (in hours) per week  | Theory: 2 hours and Practical: 1  |
| 6. Office hours | 15 hours per week |
| 7. Course code |  |
| 8. Teacher's academic profile | Ali, Taha Hussein is a professor of Applied Statistics at the University of Salahaddin. His research interests include Quality Control Charts, Robust Methods, Bayesian Approach, and Linear Models. He has published over 40 papers in prestigious journals, three books in Statistics, and received several awards for his work. He enjoys hiking and playing chess in his spare time. |
| 10. Course overview: Our overriding objective in the preparation of this book has been clarity of exposition. We hope that students, instructors, researchers, and practitioners will find these linear model texts more comfortable than most. In the final stages of development, we asked students for written comments as they read each day’s assignment. They made many suggestions that led to improvements in the readability of the book. We are grateful to readers who have notified us of errors and other suggestions for improvements to the text. |
| 11. Course objective: Another objective of the book is to tie up loose ends. There are many approaches to teaching regression, for example. Some books present estimation of regression coefficients for fixed x’s only, other books use random x’s, some use centred models, and others define estimated regression coefficients in terms of variances and covariances or in terms of correlations. Theory for linear models has been presented using both an algebraic and a geometric approach. Many books present classical (frequent) inference for linear models, while increasingly the Bayesian approach is presented. We have tried to cover all these approaches carefully and to show how they relate to each other. We have attempted to do something similar for various approaches to the analysis of variance. We believe that this will make the book useful as a reference as well as a textbook. An instructor can choose the approach he or she prefers, and a student or researcher has access to other methods as well |
| 12. Student's obligationA student has an obligation to exhibit honesty and to respect the ethical standards of the profession in carrying out his or her academic assignments. Without limiting the application of this principle, a student may be found to have violated this obligation if he or she: (see [note](http://www.pitt.edu/~provost/ainote2.html) concerning more appropriate invocation of University of Pittsburgh Student Code of Conduct and Judicial Procedures) 1. Refers during an academic evaluation to materials or sources, or employs devices, not authorized by the faculty member.2. Provides assistance during an academic evaluation to another person in a manner not authorized by the faculty member.3. Receives assistance during an academic evaluation from another person in a manner not authorized by the faculty member.4. Engages in unauthorized possession, buying, selling, obtaining, or use of any materials intended to be used as an instrument of academic evaluation in advance of its administration.5. Acts as a substitute for another person in any academic evaluation process.6. Utilizes a substitute in any academic evaluation proceeding.7. Practices any form of deceit in an academic evaluation proceeding.8. Depends on the aid of others in a manner expressly prohibited by the faculty member, in the research, preparation, creation, writing, performing, or publication of work to be submitted for academic credit or evaluation.9. Provides aid to another person, knowing such aid is expressly prohibited by the instructor, in the research, preparation, creation, writing, performing, or publication of work to be submitted for academic credit or evaluation.10. Presents as one's own, for academic evaluation, the ideas, representations, or words of another person or persons without customary and proper acknowledgement of sources. |
| 13. Forms of teachingDifferent forms of teaching will be used to reach the objectives of the course: PowerPoint presentations for the head titles and summary of conclusion, classification of material and any other illustrations. There will be classroom discussions and the lecture will give enough background to translate, solve, and analyse. |
| 14. Assessment schemeThe student must be examined twice in each course. The last grade is (30). Putting grades for daily activities, and homework, for (20) marks.The annual work of the material (40) marks.The final exam is out of (50) marks.The grades of the annual work and the final exam will be out of (100) marks and the student will be successful if he gets (50) or more.) |
| 15. Student learning outcome: Student learning outcomes statements clearly state the expected knowledge, skills, attitudes, competencies, and habits of mind that students are expected to acquire at an institution of higher education. Transparent student learning outcomes statements are:• Specific to the institutional level and/or program level •Clearly expressed and understandable by multiple audiences •Prominently posted at or linked to multiple places across the website •Updated regularly to reflect current outcomes •Receptive to feedback or comments on the quality and utility of the information provided  |
| 16. Course Reading List and References‌:1. Ali, Taha Hussien, Nazeera Sedeek Kareem, and Awaz shahab mohammad, (2021), Data de-noise for Discriminant Analysis by using Multivariate Wavelets (Simulation with practical application), Journal of Arab Statisticians Union (JASU), Vo5.No3.
2. Ali, Taha Hussein, Nasradeen Haj Salih Albarwari, and Diyar Lazgeen Ramadhan. "Using the hybrid proposed method for Quantile Regression and Multivariate Wavelet in estimating the linear model parameters." Iraqi Journal of Statistical Sciences 20.20 (2023): 9-24.
3. Ali, Taha Hussein, Avan Al-Saffar, and Sarbast Saeed Ismael. "Using Bayes weights to estimate parameters of a Gamma Regression model." Iraqi Journal of Statistical Sciences 20.20 (2023): 43-54.
4. Dobson, A. J. (1990). An Introduction to Generalized Linear Models. New York: Chapman & Hall.
5. Draper, N. R. and H. Smith (1981). Applied Regression Analysis (2nd ed.). New York: Wiley.
6. Draper, N. R. and H. Smith (1998). Applied Regression Analysis. New York: Wiley.
7. Fox, J. (1997). Applied Regresion Analysis, Linear Models, and Related Methods. Thousand Oaks, CA: SAGE Publications.
8. Freund, R. J. and P. D. Minton (1979). Regression Methods: A Tool for Data Analysis. New York: Marcel Dekker.
9. Fuller, W. A. and G. E. Battese (1973). Transformations for estimation of linear models with nested-error structure. Journal of the American Statistical Association 68, 626–632.
10. Graybill, F. A. (1976). Theory and Application of the Linear Model. North Scituate, MA: Duxbury Press.
11. Graybill, F. A. and H. K. Iyer (1994). Regression Analysis: Concepts and Applications. North Scituate, MA: Duxbury Press.
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| 17. The Topics: | Lecturer's name: |
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|  | Subject |
| First week  | * Simple Linear Regression
* The Model
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| Second week | * Estimation of the parameters
* Hypothesis Test and Confidence Interval for the parameters
* Coefficient of Determination
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| Third week | * Multiple Regression: Estimation
* Least-squares estimator for the parameters
* Geometry of Least Squares
 |
| Fourth week | * The Model in Cantered Form
* Assumptions
* Maximum Likelihood Estimators
 |
| Fifth week | * Generalized Least Squares
* Misspecification of the Error Structure
 |
| Sixth week | * Orthogonalization
 |
| Seventh week  | ➢ Tests of Hypotheses and Confidence Intervals |
| Eighth week  | * Test of Overall Regression
 |
| Ninth week  | * The General Linear Hypothesis Test
 |
| Tenth week  | * Confidence Intervals and Prediction Intervals
 |
| Eleventh week  | * Prediction Interval for a Future Observation
 |
| Twelfth week | * Likelihood Ratio Tests
 |
| Thirteenth week  | * Multiple Regression: Model Validation and Diagnostics
 |
| Fourteenth week | * The Hat Matrix
* Outliers
 |
| Fifteenth week  | * Multivariate Normal Regression Model
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 | Dr Taha Hussein AliThree hours a weekex: 15/10/2023 |
| 18. Practical Topics (If there is any) |  |
| In this section, the lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic and the date and time of the lecture. |  |