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Department of Statistics

College of administration and Economics

University of Salahaddin-Hawler

Subject: Multivariate

Course Book – 4th Year (1st semester)

Lecturer's name: Hazhar Talaat Abubaker Blbas (Ph.D.)

Academic Year: 2023-2024

**Course Book**

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| **1. Course name** | Multivariate  |
| **2. Lecturer in charge** | Hazhar T. A. Blbas |
| **3. Department/ College** | Statistics and informatics/Administration and Economics |
| **4. Contact** | e-mail: hazhar.abubaker@su.edu.krd  |
| **5. Time (in hours) per week**  | Theory: 3Practical: N/A  |
| **6. Office hours** | Tuesday: 12:30-2:30 & Thursday:8:30-10:30 |
| **7. Course code** |  |
| **8. Teacher's academic profile**  | Hazhar Blbas is a lecturer in Statistics Department in College of Administration and Economics at Salahaddin University Erbil. He gained his bachelor degree in Statistics Department at Salahaddin University and he was the third student among 132 students with average 85.516 in 2007. He has taught several classes as assistantship in this department during four years. He gained master degree scholarship in Applied Statistics at University of Central Florida in the United States of America with GPA 3.425 out of 4 on May 2014. After finishing his master degree, he came back to home to serve his country as much as he could and he has been working in several universities such as Salahaddin University, Tishk International University, Knowledge University, and Cihan University and he has taught several classes such as Principle of Statistics, Applied Statistics, Sampling, Survey, Regression Models, SPSS, and Academic Debate. He gained a Ph.D. in Applied Statistics at Salahaddin University on October 2022.He is a founder of STAT Office for Statistical Data Analysis and Training, in this center they will help all undergraduate and graduate students in writing their thesis or dissertation especially in practical section. In STAT Office, he has worked with several master and PhD students as external supervisor. Hazhar Blbas also has supervised several final projects of Bachelor in his main filed.Hazhar Blbas has published 14 papers, five of them in Scopus and one of them in Thomson Reuters and he has 84 citations from now. Also he has written one academic book entitled Elementary of Statistics by English Language which is helpful for all students who study in Statistics Department or in different major.Finally, he is an Editorial Board Member at International Research Journal of Science, Technology, Education, and Management (IRJSTEM) on August 5 2021- present |
| **9. Keywords** |  |
| 10. Course overview:  The multivarite course is related to all majors such as Economics, Analysis, Engineering, Finance, Business, Accounting, and so on. Furthermore, this course can make a decision in the sample that have collected from population and it is one of the important course for the researchers during their work in their thesis or dissertation. |
| **11. Course objective:**There are variant important tests that students have to learn in this course before they go to the next stages. Students can learn these things in below.A. Understanding types of data, and appropriate statistical tools for their analysis. B. Describing data using tables, graphs, or numbers. C. Understanding Factor AnalysisD. Understanding Principle of ComponentE. Understanding Cluster Analysis. |
| **12. Student's obligation**Students should be follow these requirements in the class:* Come to the class on time.
* Bring their lectures to the class in every day.
* Cheating will not be tolerated
* Using Social media is not allowed during the class
* Missing quizzes will not be repeated
* Bring their homework on time.
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| **13. Forms of teaching**We use different methods of teaching in this course such as PowerPoint Presentation to show them the headings as well as using white board to explain each example clearly. After each subject, I will divide students to different groups and asked them to solve a specific problem together.Furthermore, in the beginning of each class, I will make a quick review for the previous class and asked most of the students to know how much they understand in the last class, and then I will continue the new lecture. Finally, during the teaching class, I have asked some question for most of the students because I would like to participate all the students in my class. |
| **14. Assessment scheme**Midterm exam: 20 % marks.Class assignments & quizzes: there will be weekly class assignments and quizzes; 20 % marks.There will be extra assignments, which give the students extra marks.Final exam: 60 % marks.The examination schedule will be announced by the exam board of the department of statistics. |
| **15. Student learning outcome:**Students will learn:* How to do data analysis in scientific research?
* What is the best test for different datasets?
* How to make a decision from the result in different types of data analysis?
* Testing hypothesis in different datasets.
* Evaluate result of the tests based on experimental design.
* Be a good data analyst in the future
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| **16. Course Reading List and References‌:**1. PowerPoints Slides for whole semester
2. Richard Johnson and Dean Wichern, 2012, Applied Multivariate Statistical Analysis, 6th Edition
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| **17. COURSE CONTENT**

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| Week | Topic |
| 1,2 | **Chapter One : Review of Matrix Algebra** * Definition of Matrix
* Definition of Vector
* Diagonal matrix
* Matrix addition
* Matrix Subtraction
* Matrix Multiplication
* Transpose of a Matrix
* Symmetric Matrix
* Trace and Determinant of a Matrix
* Orthogonal Matrix
* Inverse Matrix
* Zero Matrix
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| 3,4 | Eigenvalues and Eigenvectors* Matrix 2x2
* Matrix 3x3
* Matrix 4x4
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| 5,6,7 | **Chapter Two : Univariate and Bivariate Normal Distribution*** Gaussian Distribution
* How Gaussian Distribution Relates to ‘Mean’ and Standard Deviation
* Parameter Estimation
* Bivariate Distribution (P=2)
* Multivariate Gaussian Distribution
* Visual Representation of Multivariate Gaussian Distribution
* Change the Standard Deviation Sigma
* Change the mean(mu)
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| 8,9,10,11 | **Chapter Three : Principle Component Analysis*** What Is Principal Component Analysis?
* Applications of PCA
* When to use the Principal Component Method of Factor Analysis?
* Assumptions of PCA
* Advantages of PCA
* Disadvantages of PCA
* HOW DO YOU DO A PRINCIPAL COMPONENT ANALYSIS?
* Example to find PC using standardized matrix
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| 12,13 | Calculating the population of Principle ComponentProportion of total variance for first, second, …, etc Principle ComponentCorrelation between component and variables |
| 14 | Midterm |
| 15 | Factor Analysis |
| 16 | Final Exam |

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| **18. Practical Topics (If there is any)** |  |
| We do not have any practical lessons at all. |  |
| **19. Examinations:****Q1/** Calculate Eigen value and Eigen value for the variance and covariance matrix as shown below$$Σ= \left(\begin{matrix}7&1&-7\\3&3&-5\\3&1&-3\end{matrix}\right)$$**Q2/** Explain each of the following statements breifly1. When do you use the Principal Component Method of Factor Analysis?
2. How do you expalin the Normality of data as one of the assumptions in PCA?
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| **20. Extra notes:**Final exam will be determined by the exam board of the college.Notice that, this syllabus may be subject to changes; we may take either longer or shorter time to finish them. |
| **21. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ**   |