Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): ORBS7250 Applied Multivariate Analysis (3,3,0)

Course Aims: This course introduces classical multivariate analysis and techniques which are useful for analyzing both designed experiments and observational studies.

Prerequisite: No

Prepared by: Yau Chin Ko

Remark: This course is delivered by staff of HKBU.

Course Intended Learning Outcomes (CILOs):

Upon successful completion of this course, students should be able to:

No.	Course Intended Learning Outcomes (CILOs)
1	Explain the fundamental principles of multivariate normal distribution and sampling theory
2	Apply hypotheses tests to analyze multivariate data
3	Evaluate the different multivariate methods
4	Analyze findings in a scientific and concise manner

Teaching & Learning Activities (TLAs):

CILO	TLAs will include the following:
1,2,3,4	Lectures with rigorous mathematical discussions and concrete examples. Lecturer will constantly ask questions in class to make sure that the majority of students are following the teaching materials.
1,2,3,4	Assignments to monitor both students' learning and mastering of the taught materials. In addition, common mistakes will also be addressed and analyzed.

Assessment:

No.	Assessment Methods	Weighting	CILO Addressed	Remarks
1	Assignments	40%	all	Assessments are designed to measure students' understanding of the theory, techniques, and applications of multivariate analysis. The assignments are conducted to monitor the students' understanding of the theory, techniques and skills taught in the class. This may involve, but not limited to, in-class discussions of rigorous technical problems and their solutions.
2	Final Examination	60%	all	Final Examination is designed to see how far students have achieved their intended learning outcomes especially in the knowledge domain. Students should have a thorough understanding of the knowledge and apply them correctly in different context to do well in the exam.

Course Intended Learning Outcomes and Weighting:

Content	CILO No.	Teaching (in hours)
1. Introduction and Matrix Algebra	1	6
2. Multivariate Normal Distribution and Its Sampling Theory	1	10
3. Tests of Hypotheses on Means and Covariance Matrices	2,4	11
4. Multivariate Methods in Multivariate Analysis	3,4	15

References:

1. R.A. Johnson and P.W. Wichern, *Applied Multivariate Statistical Analysis*, 5th Ed., Prentice -Hall International Book Company, 2002.
2. J. Han and M. Kamber, *Data Mining: Concepts and Techniques*, The Morgan Kaufmann Publishers, 2001.
3. D.F. Morrison, *Multivariate Statistical Methods*, 3rd Ed., McGraw-Hill International Book Company, 1990.
4. R. J. Roiger and M.W. Geatz, *Data Mining, A Tutorial-based Primer*, Pearson Education Inc., 2003.

Course Content in Outline:

Topic	Hours
1. Introduction and Matrix Algebra A. Introduction to multivariate analysis and data mining B. Data C. Basic statistics of a data set D. Data displays and graphical representations E. Matrix algebra	6
2. Multivariate Normal Distribution and Its Sampling Theory A. Random vector and its distribution B. Moments of multivariate distributions C. Multivariate normal distribution D. Matrix normal distribution E. Maximum likelihood estimation F. Properties of estimators	10
3. Tests of Hypotheses on Means and Covariance Matrices A. From univariate to multivariate problems B. Tests of hypotheses on means and the T^2-statistic C. Two samples problem D. Testing equality of several means E. Some tests on covariance matrices	11
4. Multivariate Methods in Multivariate Analysis A. Principal component analysis B. Factor analysis C. Corresponding analysis D. Canonical correlation analysis E. Industrial applications	15

(Approved by the Science Faculty Board Meeting 31 October 2023)
(Approved by the Department Management Committee on 5 September 2023)