Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): MATH7990 Regression Analysis (2,2,0)

Course Aims: This course introduces students the basic concepts of regression analysis. The course contents will cover the linear regression models about continuous data and generalized linear regression models about categorical data. The major aim is to equip students the fundamental knowledge to apply the regression models in real data analysis.

Prerequisite: No

Prepared by: Luo Dehui

Remarks: 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 regression models
2	Construct regression models based on real data set
3	Proceed the model diagnostic process and simple variable selection process

Teaching & Learning Activities (TLAs):

CILO	TLAs will include the following:
1,2,3	Lectures with rigorous mathematical discussions and concrete examples. The lecturer will constantly ask questions in class to make sure that the majority of students are following the teaching materials.
1,2,3	Assignments to monitor both students' learning and mastering of the taught materials. In addition, common mistakes will also be addressed and analyzed.
1,2,3	Students can learn to apply the course contents in real case studies by conducting individual (or group) project

Assessment:

No.	Assessment Methods	Weighting	CILO Addressed	Remarks
1	Assignments and class exercises.	30%	all	Assessments and class exercise are designed to measure how well the students recognizing of the theory, techniques, and applications of data analytics. This may involve, but not limited to, in class discussions of rigorous technical problems and their solutions.
2	Project	20%	all	A written report (~2000-4000 words) on the use of regression models applied to a realistic case-study problem. The coursework will assess students' comprehension of key topics introduced in the course, as well as require them to demonstrate their model building and analytical skills.
3	Exam	50%	all	A written test on the course concepts. Focus more on the calculation.

Course Intended Learning Outcomes and Weighting:

Content	CILO No.	Teaching (in hours)
1. Simple Linear Regression	1,2	3
2. Multiple Linear Regression	1,2	3
3. Diagnostic for Linear Regression Model	1,2,3	4
4. Multicollinearity and Heteroskedasticity	1,2,3	4
5. Polynomial Regression	1,2	2
6. Variable Selection and Model Building	1,2,3	4
7. Logistic Regression Models	1,2,3	2
8. Poisson Regression Models	1,2,3	2
9. Generalized Regression Models	1,2,3	4

References:

1. Montgomery, D. C., Peck, E. A., & Vining, G. G. (2012). *Introduction to linear regression analysis* (Vol. 821). John Wiley & Sons.
2. Draper, N. R., & Smith, H. (1998). *Applied regression analysis* (Vol. 326). John Wiley & Sons.
3. Radhakrishna Rao, C., Toutenburg, H., & Heumann, C. (2008). Linear models and generalizations: least squares and alternatives.
4. Monahan, J. F. (2008). *A primer on linear models*. CRC Press.
5. Khuri, A. I. (2009). *Linear model methodology*. CRC Press.
6. Myers, R. H., & Myers, R. H. (1990). *Classical and modern regression with applications* (Vol. 2). Belmont, CA: Duxbury press.
7. Agresti, A. (2018). *An introduction to categorical data analysis*. John Wiley & Sons.

Course Content in Outline:

Topic	Hours
1. Simple Linear Regression	3
– Basic concepts: assumptions, model properties, variable characteristics	
2. Multiple Linear Regression	3
– Basic concepts: assumptions, model properties, variable characteristics	
– Comparison with simple linear regression model	
3. Diagnostic for Linear Regression Model	4
– Model diagnostic rules, e.g. hypothesis tests, coefficient significance, etc	
– Model performance evaluation and prediction	
4. Multicollinearity and Heteroskedasticity	4
– Introduce basic theories of multicollinearity and heteroscedasticity	
– Rules of thumb about multicollinearity and heteroscedasticity detection	
5. Polynomial Regression	2
– Basic concepts: model settings, assumptions, variable transformation, etc	
– Comparison with linear models	
6. Variable Selection and Model Building	4
– Variable selection criteria	
– Analysis of variance (ANOVA)	
– Residuals and partial residuals	
7. Logistic Regression Models	2
– Basic concepts: assumptions, model properties, variable characteristics	
– Model interpretation	
– Comparison with linear models	
8. Poisson Regression Models	2
– Basic concepts: assumptions, model properties, variable characteristics	
– Model interpretation	
– Comparison with logistic regression models and linear regression models	
9. Generalized Regression Models	4
– Basic concepts: assumptions, model properties, variable characteristics	
– Model interpretation	
– Comparison with nonlinear and linear regression models	
– Practical applications	

(Approved by the Science Faculty Board Meeting on 27 February 2025)
(Approved by the Department Management Committee on 26 January 2025)

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