

**Hong Kong Baptist University**  
**Faculty of Science**  
**Department of Mathematics**

**Title (Units):**     **STAT 2110 REGRESSION ANALYSIS (3,3,0)**

**Course Aims:** This course aims to provide an understanding of the classical and modern regression analysis and techniques which are widely adopted in various areas such as business, finance, biology, and medicine. There have been great developments in the past decades such as nonlinear regression, robust regression, nonparametric regression etc. With the help of a statistical package such as SAS, Matlab or R, students can analyze multivariate data by modern regression techniques without any difficulty.

**Prerequisite:**     STAT1131 and STAT1132 and MATH1120

**Prepared by:**     S.N. Chiu

**Learning Outcomes (LOs):**

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	<b>Knowledge</b>
1	Able to understand the basic matrix algebra for regression analysis
2	Able to understand different distributions used in regression analysis
3	Able to know the general procedures of statistical inference (including parameter estimation and hypothesis testing ) for linear regression models
4	Able to conduct model selection
5	Able to perform model diagnostics
6	Able to know basic procedures for non-linear regression analysis
	<b>Skills</b>
7	Able to manipulate the software SAS
8	Able to build up linear regression models
9	Able to perform statistical computations involving parameter estimation, hypothesis testing and confidence interval construction in regression analysis
10	Able to select appropriate models
11	Able to examine some model assumptions and identify unusual observations
12	Able to extend their knowledge of statistical techniques for non-linear regression models
	<b>Attitudes</b>
13	Able to work effectively in a team
14	Able to solve problems independently
15	Able to appreciate the diversity of the applications of regression model

**Assessment:**

No.	Assessment Methods	Weighting	Remarks
1	Continuous Assessment (assignments, test, and mini-project)	40%	Assignments are designed to measure how well the students have learned various techniques for regression analysis. The students will learn to use the software SAS to solve real life problems. The team-project is designed to stimulate students' interest in furthering understanding and analyzing practical problems in real life situations.
2	Final Examination	60%	Final Examination is designed to see how far students have achieved their intended learning outcomes in both Knowledge and Skills domains. Students should have a thorough understanding to apply statistical methods and models to real data and draw inference. They are also expected to identify steps in the modeling process, understand the underlying assumptions implicit in each family of models, and recognize which assumptions are applicable.

**Learning Outcomes and Weighting:**

Content	LO No.	Teaching (in hours)
I. Introduction	1-2	7
II. Simple Linear Regression Model	2-3, 7, 15	9
III. Multiple Linear Regression Models	2-3, 7-8, 13-15	8
IV. Selection of Variables	2-4, 7, 10, 13-15	6
V. Statistical Diagnostics	2-4, 5, 7, 11, 13-15	8
VI. Nonlinear Regression Analysis	3, 6, 7, 12, 15	3

**Textbook:** W. Mendenhall and T. Sincich, A Second Course In Statistics: Regression Analysis, 7<sup>th</sup> Ed., Pearson, 2011.

**References:** Raymond H. Myers, Classical And Modern Regression With Applications, 2<sup>nd</sup> Ed., PWS-KENT, 1990.  
G.B. Wetherill, Regression Analysis with Applications, Chapman and Hall, 1986.  
A Sen and M. Srivastava, Regression Analysis, Theory, Methods and Applications, Springer-Verlag, 1990.

**Software:** SAS. Matlab or R

## Course Content in Outline:

	<b><u>Topic</u></b>	<b><u>Hours</u></b>
I.	Introduction A. Regression analysis B. Some matrix algebra C. Moments of a random vector D. Multivariate normal distribution	7
II.	Simple Linear Regression Model A. Simple linear models B. Least squares estimation C. Properties of the least squares estimator D. Correlation and decomposition of the sum of squares E. Discussion	9
III.	Multiple Linear Regression Models A. Model description B. Estimation C. Properties of the least squares estimators D. Various hypothesis tests E. Multicollinearity in multiple data F. Quality of fit and prediction	8
IV.	Selection of Variables A. Contribution of a variable in the model B. Forward selection and backward elimination C. Stepwise procedure D. All possible subsets and other techniques of selection variables	6
V.	Statistical Diagnostics A. Analysis of residuals B. Diagnostic plots C. Detection of outliers D. Influence diagnostics	8
VI.	Nonlinear Regression Analysis A. Nonlinear regression model B. Estimation of the parameters	3