



## Nanchang University MATH 34: Regression Analysis

**Credit:** 4

### ***Contact Hours***

This course is composed of 24 lecture sessions, 3 tutorial sessions and 9 office contact hours. Each lecture session takes 2 contact hours in length; each tutorial session takes 3 contact hours in length; There will be a Q-A review session (3 contact hours) and Final Exam (3 contact hours) at the end of this term. This course has 72 contact hours in total.

### ***Course Description***

This course is intended to familiarize students with an understanding of the basic principles and the mathematical theory necessary to apply regression model-building techniques in a wide variety of application environments. It covers various topics of regression models, mainly focusing on Simple Linear Regression Models, the Multiple Linear Regression Model, Polynomial Models, Nonlinear Regression Models, Generalized Linear Models (including the Binomial & Binomial Distribution and the Poisson Distribution and etc.), Logistic and Probit Regression Models and etc. Students are expected to identify, understand and apply these linear regression models by estimation and Inference.

Basic knowledge in statistics and calculus are required.

### ***Required Material***

*Methods and Applications of Linear Models: Regression and the Analysis of Variance* by Ronald R. Hocking, 3<sup>rd</sup> edition, Wiley, ISBN: 1118329503.

*Generalized Linear Models* by John P. Hoffmann, Pearson; ISBN: 0205377939.

### ***Reference Reading***

*Introduction to Linear Regression Analysis* by Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, Wiley-Interscience, ISBN: 0471754951.

### ***Grading***

- Attendance 10%



- Quizzes 20%
- Midterm 30%
- Final Exam 40%

A+ 96-100	A 90-95	A- 85-89
B+ 82-84	B 78-81	B- 75-77
C+ 71-74	C 66-70	C- 62-65
D 60-61	F < 60	

### ***Course Schedule***

The course has 24 class sessions in total. All sessions are 2 contact hours in length. At the end of this term, there will be a Q-A review session(3 contact hours) and Final Exam (3 contact hours).

Note: the course outline and required readings are subject to change.

Class 1:

Introduction to the course  
What is Regression Analysis ?

Class 2:

Definition of the Linear Model  
Examples of Regression Models  
How to Estimate a Linear Regression Model?

Class 3:

Regression on Functions of One Variable  
The Simple Linear Regression Model  
Parameter Estimation; Properties of the Estimators and Test Statistics  
Quiz 1

Class 4:

The Analysis of Simple Linear Regression Models  
Examining the Data and the Model  
Polynomial Regression Models

Class 5:

Transforming the Data  
Transformations to Achieve a Linear Model  
Analysis of the Transformed Model

Class 6:

Regression on Functions of Several Variables  
The Multiple Linear Regression Model



## Analysis of the Multiple Linear Regression Model

### Class 7:

Collinearity in Multiple Linear Regression

The Collinearity Problem and an Example with Collinearity

Remedial Solutions: Biased Estimators

Quiz 2

### Class 8:

Influential Observations in Multiple Linear Regression

The Influential Data Problem; Numerical Measures of Influence

Plots for Identifying Unusual Cases; Robust/Resistant Methods in Regression Analysis

### Class 9:

Polynomial Models and Qualitative Predictors

The Analysis of Response Surfaces

### Class 10:

Midterm

### Class 11:

Nonlinear Regression Models

Nonparametric Model-Fitting Methods

Quiz 3

### Class 12:

Generalized Linear Models; The Role of the Link Function

The Binomial Distribution; The Binomial Distribution

### Class 13:

The Poisson Distribution; The Negative Binomial Distribution

How Do We Estimate Regression Models Based on These Distributions?

How to Check the Significance of Coefficients and the "Fit" of the Model?

Quiz 4

### Class 14:

Logistic and Probit Regression Models

What Are the Alternatives to the Linear Regression Model?

Diagnostic Tests for the Logistic Regression Model

### Class 15:

Ordered Logistic and Probit Regression Models

The Multinomial Logistic Regression Model



Class 16:

Poisson and Negative Binomial Regression Models

The Poisson Regression Model and Diagnostic Tests for the Poisson Regression Model

Class 17:

Event History and Survival Models

Continuous versus Discrete Time Models

The Basics: Survivor and Hazard Functions and Curves

Class 18:

Random Input Variables; Errors in the Inputs; Calibration

The Mathematical Theory of Linear Models

Class 19:

The Mathematical Theory of Linear Models

The Distribution of Linear and Quadratic Forms

Class 20:

Estimation and Inference for Linear Models

Tests of Linear Hypotheses on  $\beta$ ; Confidence Regions and Intervals

Quiz 5

Class 21:

Classification Models II: Multiple Crossed and Nested Factors

Mixed Models I & II & III; The General Analysis for Balanced, Mixed Models

Class 22:

Simultaneous Inference: Tests and Confidence Intervals

Class 23:

Simultaneous Inference: Tests and Confidence Intervals(Cont)

Class 24:

Overall Review and discussion

### ***Attending Policy***

Regular and prompt attendance is required. Under ordinary circumstances, you may miss two times without penalty. Each absence over this number will lower your course grade by a third of a letter and missing more than five classes may lead to a failing grade in the course. Arriving late and/or leaving before the end of the class period are equivalent to absences.

### ***Policy on "Late Withdrawals"***



In accordance with university policy, appeals for late withdrawal will be approved **ONLY** in case of medical emergency and similar crises.

### ***Academic Honesty***

Nanchang University expects all students to do their own work. Instructors will fail assignments that show evidence of plagiarism or other forms of cheating, and will also report the student's name to the University administration. A student reported to the University for cheating is placed on disciplinary probation; a student reported twice is suspended or expelled.

### ***General Expectations:***

Students are expected to:

- Attend all classes and be responsible for all materials covered in class and otherwise assigned;
- Complete the day's required reading and assignments before class;
- Review the previous day's notes before class and make notes about questions you have about the previous class or the day's reading;
- Participate in class discussions and complete required written work on time;
- Refrain from texting, phoning or engaging in computer activities unrelated to class during the class period;
- While class participation is welcome, even required, you are expected to refrain from private conversations during the class period.

### ***Special Needs or Assistance***

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.