Institute of Information Management/
Department of Industrial and Information Management - Graduate Program

R351200
Empirical Model-Building Methods
（經驗模式方法）（英文授課）

Fall 2011

1. This mission of the College is to serve business and society in the global economy through developing quality and socially responsible professionals and business leaders.

2. The strategic objective of Department of Industrial and Information Management is to cultivate industrial and information management professionals who possess TIP (Technological knowledge, Innovative foundation, and Perceptive learning).

General Program Learning Goals (goals covered by this course are indicated):

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<tr>
<td>1</td>
<td>Graduates should be able to communicate effectively verbally and in writing.</td>
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<td>2</td>
<td>Graduates should solve strategic problems with a creative and innovative approach.</td>
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<td>3</td>
<td>Graduates should demonstrate leadership skills demanded of a person in authority.</td>
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<td>4</td>
<td>Graduates should possess a global economic and management perspective.</td>
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<td>5</td>
<td>Graduates should possess the necessary skills and values demanded of a true professional.</td>
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Instructor: Yu-Ching Chang, PhD

Office: IIM 61329  Office Hours: Tuesday 13:00-15:00 or by appointment
Tel: 06-2757575#53132  E-mail: ycchang@mail.ncku.edu.tw

Prerequisites: Statistics I & II
Recommended: Matrix Algebra

Lecture Hours: Wednesday 16:10-17:00, Friday: 13:10-15:00
Location: 61208
Software Labs: Usually scheduled on Wednesday, 16:10-17:00 and will be announced in advance

Course Website: http://myweb.ncku.edu.tw/~ycchang/EMM/

Course Description:
This course explores the topics of relating a response variable to a number of predictor variables. A *mechanistic model* can be used to establish the relationship if the underlying physical mechanism is known. However, due to lack of knowledge of the true mechanism, a *mechanistic model* is usually unknown. An *empirical model* approximates the unknown *mechanistic model* by linear models through observed data, which can be collected by experimental designs or simply historically events.
This course is complemented by statistical software R.

**Course Objectives:**
Students are expected to be familiar with the following tasks:
1. To build an empirical model and to understand theoretical basis
2. To perform hypothesis testing on the model
3. To check the model adequacy
4. To use statistical software R

**Textbook:**
- Box, Draper (1987), Empirical Model-Building and Response Surfaces, Wiley (滄海圖書代理)

**Reference:**
- Weisberg (2005), Applied Linear Regression, 3rd edition, Wiley
- Myers, Montgomery, Vining (2010), Generalized Linear Models: with Applications in Engineering and the Sciences, Wiley

**Tentative Course Schedule:**
W1: Introduction, Exploratory Data Analysis (EDA)
W2: Statistics and Matrix Algebra Review
W3: Simple Linear Regression
W4: Multiple Linear Regression
W5: Model Adequacy Checking
W6: R Labs
W7: Data Transformations
W8: Leverage, Influential Observations, Outliers
W9: Indicator Variables
W10: Midterm Exam
W11: R Labs
W12: Multicollinearity (Project Proposal)
W13: Variable Selection and Model Validation
W14: Principal Component Regression, Ridge Regression
W15: Two-Level Factorial Designs
W16: Generalized Linear Models
W17: Logistic Regression, Poisson Regression, Multinomial Logistic Regression
W18: Project Presentations, Final Exam
Grading Policy:

- Homework assignments: 20%
- Midterm: 30%
- Final exam: 30%
- Group project: 20%

Grading Policy for AACSB Multiple Assessment:

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<tr>
<th>Category</th>
<th>HW 20%</th>
<th>Midterm 30%</th>
<th>Final 30%</th>
<th>Project 20%</th>
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<td>COMMU</td>
<td>☑ Oral Commu./ Presentation</td>
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<td>☑ Written Communication</td>
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<td>CPSI</td>
<td>☑ Creativity and Innovation</td>
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<td>☑ Problem Solving</td>
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<td>☑ Analytical Skills</td>
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<td>☐ Social responsibility</td>
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<td>GLOB</td>
<td>☐ Global Awareness</td>
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<td>VSP</td>
<td>☐ Values, Skills &amp; Profess.</td>
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<td>☐ Information Technology</td>
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<td>☐ Management Skills</td>
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Homework Assignments:
There will be 4 assignments. You are encouraged to discuss the work with your classmates, but you MUST write up your own submission individually. Late assignments receive a 20% penalty. No late homework will be accepted after 24 hours. Homework solutions will be posted on the course website next day when it is due. You may submit your homework electronically (in Words or PDF format) to instructor’s email box, but you will get less feedback due to the difficulty in making comments.

Exams:
The in-class midterm exam is closed book, but you are allowed to prepare an A4 sheet, on which you can write anything you think might be useful. The A4 sheet must be handwritten with your name signed on it. Your A4 sheet has to be turn in with your answer sheets after the exam. The take-home final exam is similar to a homework assignment, but a bit larger. Statistical software is required. You can make use of books or any sources. However, you must complete it independently, meaning that you cannot discuss with your classmates or anybody else other than the instructor.

Group project:
We will start the group project after the midterm. Groups are formed by the instructor and each
group has about 3 students. You have to choose your research question and select (or collect) your own data set. Two weeks after groups are formed, each team must submit a research proposal, on which briefly describe your research question and variables in your data set. Students are required to present their projects during the last week of classes. Presentations should last at least 15 minutes and no longer than 20 minutes. The grade of the group project is based on your presentation (50%) and written report (50%).

Computing Software:
We use the statistical software R. The software is free and source code opened under the GNU license and has enormous advanced statistical modules supported by academics. Most examples in class will be given in R. The official website for R is http://cran.r-project.org/. You can find plenty of R guides at http://cran.r-project.org/other-docs.html.
You can also use Minitab, S-PLUS, SAS, or SPSS for your assignments and project.