Applies Statistics

1. Course Description

Based on the introduction of concepts and techniques of elementary statistics, this course is to examine how managers could use data for systematic business problem-solving. Topics include data collection, descriptive statistics measures, probability, statistical inference, hypothesis testing, analysis of variance (ANOVA), regression analysis, model building forecasting, risk analysis and applications in quality and productivity management. Special emphasis will be given to computer techniques, especially using Microsoft Excel, for statistical analysis and problem solving in the context of the functional areas of business. This course is designed to provide students with the essential tools used in Data Analysis and applications in common business process and management. Teaching methods are lecture, assignments, and cases.

2. Course Objectives and Requirements

1.**Course Objectives**：

There are a lot of data or information in the functional areas of business: accounting, finance, management, and marketing. Statistics methods are commonly used to make right decisions based on the available data or information. In this context, this course is to examine important tools for critical thinking, decision making under uncertainty, and quantitative data analysis and applies them in business and economic decision situations. The objectives are to help students assess risk, understand data, and apply statistical tools for problem solving. By the end of the course, students will be able to:

(1). identify appropriate data needs and acquire information to improve decision making organize and display relevant data clearly and effectively

(2). draw conclusions about populations, based on sample information

(3). understand and do estimations using confidence intervals and hypothesis testing

(4). obtain reliable forecasts of variables of interest using simple linear regression and multiple regression analysis

(5). understand ethical issues in data analysis and presentation

(6). interpret results of statistical analysis of data

(7). effectively communicate results to others

(8). deeply understand ethics, responsibility and sustainability for the data science and statistics

2. **Requirements**： The students are expected to get prepared for lectures, finish and submit assignments as required.

3. Course Arrangement

Course name		Applied Statistics	Total Credit Hours	54
unit	Credit hours	Contents	Preparation of class and reading materials	Cases
1	3	Unit One：Introduction and Data Collection 1. The importance of Applied Statistics 2. Why are data needed 3. Sources of data 4. Types of data 5. Types of sampling methods 6. Evaluating survey worthiness	1. Chapter 1 of Textbook（Levine et al.）	
2	3	Unit Two：Researching Data in Tables and Charts 1. Organizing numerical data 2. Tables and charts for numerical data 3. Graphing bi-variate numerical data 4. Tables and charts for categorical data 5. Tabulating and graphing bi-variate categorical data 6. Ethics and responsibilityabout graph and tables, like should not distort the data	1. Chapter 2 of Textbook（Levine et al.）	
3	3	Unit Three：Numerical DescriptiveMeasures 1. Exploring numerical data and their properties	2. Chapter 3 of Textbook（Levine et al.）	Case 1: Find a data set (any topic) published by some

		2. Measures of central tendency, variation and shape 3. Exploratory data analysis 4. Obtaining descriptive summary measures from a population 5. The coefficient of correlation 6. Pitfalls in numerical descriptive measures and ethical issues		authority, for example, Purchasing Managers Index (PMI), Consumer Price Index (PMI), then conduct some analysis with descriptive measures. The analysis should be as overall and comprehensive as possible, and try to figure out the possible underlying reasons for results you obtained. If you can collect data by yourself with some survey, it would be better, but it is not mandatory. Each group is required to make a presentation about your results and explanation.
4	6	Unit Four : Basic Probability and Discrete Probability Distribution 1. Basic probability concepts 2. Conditional probability 3. Bayes' Theorem 4. The probability distribution for a discrete random	1. Chapter 4 of Textbook（Levine et al.）	

		variable 5. Covariance and its application in finance 6. Binomial distribution 7. Poisson distribution 8. Hypergeometric distribution 9. Ethical issues and probability		
5	6	**Unit Five : The Normal Distribution and Sampling Distributions** 1. The normal distribution 2. Evaluating the normality assumption 3. The exponential distribution 4. Introduction to sampling distribution 5. Sampling distribution of the mean 6. Sampling distribution of the proportion	1. Chapter 5 of Textbook （Levine et al.）	
6	6	**Unit Six: Confidence Interval Estimation** 1. Confidence intervals for the population mean(σ known) 2. Confidence intervals for the population mean(σ unknown) 3. Confidence intervals for the population proportion	1. Chapter 6 of Textbook （Levine et al.）	Case 2: Understanding political polls (see attachment)

		4. Determining the sample size 5. Applications of confidence interval estimation in auditing 6. Confidence interval estimation and ethical issues		
7	6	**Unit Seven: Fundamentals of Hypothesis Testing: One-Sample Tests** 1. Hypothesis testing methodology 2. Z Test for the mean (σ known) 3. Critical value and p–value approaches to hypothesis testing 4. One-tail and two-tail tests 5. t test for the mean (σ unknown) 6. Z test for the proportion 7. Pitfalls and ethical issues	1. Chapter 7 of Textbook（Levine et al.）	
8	3	**Unit Eight: Two-sample Tests with Numerical Data** 1. Test hypotheses for the difference between two independent population means (standard deviations known or unknown) 2. Test two means from related samples for the mean difference	1. Chapter 8 of Textbook（Levine et al.）	

		3. Complete a Z test for the difference between two proportions 4. Use the F table to find critical F values 5. Complete an F test for the difference between two variances		
9	6	**Unit Nine: Analysis of Variance** 1. The logic of ANOVA 2. ANOVA assumptions 3. F test for difference in c means 4. The Tukey-Kramer procedure for multiple comparisons 5. two-way analysis of variance	2. Chapter 9 of Textbook（Levine et al.）	
10	6	**Unit Ten: Simple Linear Regression** 1. Types of regression models 2. Determining the simple linear regression equation 3. Measures of variation 4. Assumptions 5. Residual analysis 6. Measuring autocorrelation: the Durbin-Watson statistic 7. Inferences about the slope and correlation coefficient	1. Chapter 11 of Textbook （Levine et al.）	

		8. Estimation of mean and prediction of individual values 9. Computations in simple linear regression		
11	6	**Unit Eleven: Multiple Regression** 1. Developing the multiple regression model 2. Residual analysis for the multiple regression model 3. Testing for the significance of the multiple regression model 4. Inferences concerning the population regression coefficients 5. Testing portions of the multiple regression model 6. The quadratic regression model 7. Dummy variable models 8. Using transformations in regression models 9. Collinearity 10. Model building	1. Chapter 12 of Textbook （Levine et al. ）	Case 3: Pilgrim Bank (A): Statistics Review with Data Desk (see attachment)

4. Teaching Methods

Lectures、Discussions、Case Analysis, etc.

5. Learning Outcomes Expected

Category	Learning Outcomes
Master of Knowledge	1. Master the tables and charts for categorical and numerical data 2. Master how to describe the properties of central tendency, variation and shape in numerical data 3. Master how to calculate descriptive summary measures for a population 4. Familiar with basic probability concepts and conditional probability 5. Master Bayes' theorem 6. Master how to Interpret the mean and standard deviation for a discrete probability distribution 7. Familiar with binomial, Hyper geometric, Poisson distribution 8. Familiar with normal, uniform and exponential distribution 9. Master the sampling distribution of the mean and of the proportion 10. Master confidence interval estimate of mean and proportion 11. Understand the basic concept of hypothesis 12. Know how to use the critical value and p-value approaches to test the null hypothesis (for both mean and proportion problems) 13. Master how to test hypotheses for the difference between two population 14. Understanding the ANOVA and master how to conduct one-factor ANOVA 15. Master the simple linear regression 16. Master the multiple regression

Intellectual abilities learned	1. Have the ability to analyzes social or economical problems with the view of inferential statistics
	2. Have the ability to read research papers in the field of applied statistics
	3. Pay attention to the advanced developments in the field of applied statistics
	4. Identify appropriate data needs and acquire information to improve decision making organize and display relevant data clearly and effectively
	5. Identify and apply appropriate analytical techniques to analyze data
	6. Understand the concept of probability, understand and work with discrete and continuous probability distributions
	7. Draw conclusions about populations, based on sample information
	8. Understand and do estimations using confidence intervals and hypothesis testing
	9. Understand how to improve process
Practical skills learned	1. Master applications of Excel to solve various different statistics problems
Personal competences and characters Cultivated	1. The competence of thinking questions by using some key techniques of statistics
	2. The competence of inferential knowledge by using some key techniques of statistics
	3. Foster the ability of integrated theoretical study and experiments study together
	4. Have the charm of leadership and responsibility
	5. The team spirit of cooperation

6. Performance Evaluation: Means & Ratio

Evaluation	Ratio	Relation to the Intended Learning Outcomes

Means	（%）	
Team and individual assignments	50	All categories
Attendance and Engagement	10	Evaluate the abilities of understand and application of statistics knowledge related and the abilities of team participation and effective communication
Exam	40	All categories

7.Textbook，References and Reading Materials

1) Textbook

[1]David M. Levine, David F. Stephan, Timothy C. Krehbiel, and Mark L.Berenson, Statistics for Managers Using Excel (3rd Edition), Prentice Hall, New Jersy, 2002

2) Online resources

[1] http://www.lib.tongji.edu.cn/

[2] http://wps.prenhall.com/bp_levine_statsexcel_5/65/16643/4260778.cw/index.html

[3] http://www.prenhall.com/springville/SpringvilleSFM5e.htm

3) Periodicals and Magazines

[1]. Management World

[2]. Management Review

[3]. Nankai Business Review

[4]. Journal of Applied Econometrics

[5]. Statistics & Probability Letter

[6]. Journal of Statistical Planning and Inference

[7]. Computational Statistics & Data Analysis

[8]. Statistical Methodology

[9]. Journal of Multivariate Analysis

[10].   Statistical Science

[11].   Annals of Statistics

[12].   Annals of Probability

8. Cases

[1] Case 1 (Self-designed case): Find a data set (any topic) published by some authority, for example, Purchasing Managers Index (PMI), Consumer Price Index (PMI), then conduct some analysis with descriptive measures. The analysis should be as overall and comprehensive as possible, and try to figure out the possible underlying reasons for results you obtained.

If you can collect data by yourself with some survey, it would be better, but it is not mandatory.

Each group is required to make a presentation about your results and explanation.

[2] Understanding political polls, IVEY, 807E16

[3] Pilgrim Bank (A): Statistics Review with Data Desk, Harvard Business School, 9-602-104

9. Assignment Requirements

For each case, combine with the statistics theory and knowledgerelated, describe, analyze and evaluateproblems existed, and put forward some solutions and alternatives.

Requirements

1) Collect this case background information and discuss about the problems above

2) Form the groups，each group consists of 2-6students.

3) Do presentation in the class, each group need to submit PPT and the WORD (one copy of the electronic version and paper version)

4) Each group should prepare before classcarefully, please.

The criteria ofassignment evaluation (100 points)

1) Whether the case material collection is completed or not   20 points

2) Whether the case analysis is system in-depth or not   25 points

3) Whether the insights is correct or not   25 points

4) Participation of group members in case discussion   20 points

5) Whether the PPT and document is made seriously and beautiful 10 points

Appendices:

1. The course PPT

2. Case material