东北大学秦皇岛分校本科课程教学大纲

一、课程基本信息

<table>
<tr><td>开课单位</td><td colspan="3">悉尼智能科技学院</td><td>课程代码</td><td colspan="5">3100312007</td></tr>
<tr><td>中文名称</td><td colspan="8">统计学导论</td></tr>
<tr><td>英文名称</td><td colspan="8">Introduction to Statistics</td></tr>
<tr><td>总学时</td><td>60</td><td rowspan="2">理论学时</td><td rowspan="2">48</td><td rowspan="2">实验学时</td><td rowspan="2">12</td><td rowspan="2">上机学时</td><td rowspan="2">0</td><td rowspan="2">设计学时</td><td rowspan="2">0</td><td rowspan="2">课外学时</td><td rowspan="2">0</td></tr>
<tr><td>学　分</td><td>3.5</td></tr>
<tr><td>课程类型</td><td colspan="11">☐理论课程　☑理论（含实验）课程　☐实践类课程</td></tr>
<tr><td>课程类别</td><td colspan="11">☐通识类　☑学科基础类　☐专业方向类　☐实践类</td></tr>
<tr><td>适用专业</td><td colspan="11">应用统计学</td></tr>
<tr><td>先修课程</td><td colspan="11">无</td></tr>
<tr><td>建议开课学期</td><td colspan="11">☐1-1 ☑1-2 ☐2-1 ☐2-2 ☐3-1 ☐3-2
☐4-1 ☐4-2 ☐5-1 ☐5-2 ☐*（代表每学期都开设）</td></tr>
<tr><td>考核方式</td><td colspan="4">☑考试 ☐考查</td><td>成绩分制</td><td colspan="5">☑百分制 ☐五级制 ☐二级制</td></tr>
<tr><td>使用教材</td><td colspan="11">1、Walpole, Myers, Myers, Ye, Probability & Statistics for Engineers & Scientists, 9th Edition, GLOBAL EDITION, Pearson Education Limited, 2016</td></tr>
<tr><td>参考书及教学资源</td><td colspan="11">1. William Mendenhall, Introduction to Probability and Statistics, Cengage, 2019
2. 罗纳德 • 沃波尔; 雷蒙德 • 迈尔斯; 沙伦 • 迈尔斯, 概率与统计（理工类第九版）, 中国人民大学出版社, 2016
3. 王殿坤, 概率论与数理统计,科学出版社, 2021</td></tr>
<tr><td>其他说明</td><td colspan="11">无</td></tr>
</table>

二、课程简介

中文描述

统计学导论是应用统计学专业的必修课，主要包括概率论的重要概念，经典统计推断及其与概率论的联系，抽样分布及其在置信区间及假设检验中的应用，以及简单的线性回归和方差分析技术。本课程培养学生使用概率语言在统计框架中的研究技能和解决复杂问题的能力，对取得的成果在社会主义核心价值观下进行批判性评价和分析，并以各种方式向不同的受众（专家和非专家）简洁准确地表达信息、推理和结论。

English Description

Introduction to Statistics is a required course for Applied Statistics. This subject mainly introduces the students to important concepts in probability, classical statistical inference and its connection to probability theory, sampling distributions and their use in constructing confidence intervals and hypothesis testing, simple linear regression, and analysis of variance techniques. Students learn how to use the language of probability, and how this is applied in a statistical framework to solve outstanding problems with a critical evaluation and analysis of the obtained results account for the core socialist values then succinct and accurate presentation of information, reasoning, and conclusions in a variety of modes, to diverse audiences (expert and non-expert).

三、课程目标

1、知识目标：

1-1：掌握统计学领域的基础理论、基础知识和基本原理，建立良好的定量分析方法论基础。

2、能力目标：

2-1：正确处理数据资料的统计分析能力。

2-2：灵活应用各种基础的统计学方法综合分析现实现象中存在的实际问题。

3、德育/素养目标：

3-1：具有正确的价值观与社会责任感、优秀的职业道德与行为规范。

3-2：坚定“融贯东西、鼎新致远”的奋斗信念，胸怀“自强不息、知行合一”的东大品格，成为有理想、有本领、有担当的时代英才。

表 1 课程目标与毕业要求的对应关系

毕业要求	指标点	课程目标	关联性（H/M/L）
1. 理学知识：具有扎实的数学基础，能够将数学、自然科学和专业知识用于解决复杂实际问题。	1-2 掌握统计调查、统计数据处理、统计分析、计算机与统计软件使用等应用统计学的基本理论、知识与方法，具备采集、处理、分析数据的能力，熟悉预研报告、可行性分析报告、研究方案等文档的撰写规范；	1-1、3-1	H
2. 问题分析：能够借助应用统计学的基本原理、方法和手段，识别、表达、并通过文献研究分析复杂实际问题，以获得有效结论。	2.1 能够借助应用统计学的基本原理、方法和手段，分析、识别、表达本专业相关的复杂实际问题；	2-1、2-2、3-2	M

四、主要教学内容

（一）理论教学

第 1 章 Introduction to Statistics and Data Analysis （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】知识点：

（1）Data collection；Location and variability measure.

（2）Discrete and continuous variables.

（3）Graphical inspections.

（4）Sample spaces and events.

【2】学习目标：

了解：What’s Sample and Population.

理解：Sample spaces and events.

掌握：Location and variability measure; Graphical inspections.

【3】重点内容：

Location and variability measure; Graphical inspections.

【4】难点内容：

Graphical inspections.

【5】思政案例：

Introduce the impact of biases in the data collection process on statistical results.

第 2 章：Probability （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】知识点：

（1）Events; Counting outcomes; Probability of events.

（2）Conditional probability, independence and the product rule.

（3）The law of total probability; Bayes' rule.

【2】学习目标：

了解：Events, Counting outcomes.

理解：Probability of events.

掌握：Conditional probability, independence, the product rule, The law of total probability; Bayes' rule.

【3】重点内容：

Conditional probability; independence; The law of total probability; Bayes' rule.

【4】难点内容：

The law of total probability; Bayes' rule.

【5】思政案例：

Introduce the conditional probability of aircraft being hit during war, explain the application of statistical knowledge in war, and talk about the scientific border issues.

第 3 章：Random Variables and Probability Distribution （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】知识点：

（1）Random variables, discrete and continuous.

（2）Discrete probability distributions.

（3）Continuous probability distributions.

（4）Joint, marginal and conditional probability.

（5）Statistical independence.

【2】学习目标：

了解：Random Variables

理解：All kinds of probability distributions.

掌握：All kinds of probability distributions.

【3】重点内容：

All kinds of probability distributions.

【4】难点内容：

Joint probability distributions.

第 4 章：Mathematical Expectation （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】知识点：

（1）Expected value of a random variable.

（2）Variance and covariance of random variables.

（3）Means and variances of linear combinations.

（4）Means and variances of linear combinations.

【2】学习目标：

了解：Chebyshev's Theorem.

理解：Means and variances of linear combinations.

掌握：Expected value of a random variable, Variance, and covariance of random variables.

【3】重点内容：

Variance

【4】难点内容：

Means and variances of linear combinations.

第 5 章：Some Discrete Probability Distributions （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】知识点：

（1）Introduction to discrete probability distributions.

（2）Binomial distribution.

（3）Hypergeometric distribution.

（4）Negative binomial and geometric distributions.

（5）Poisson distribution and the Poisson process.

【2】学习目标：

了解：Introduction to discrete probability distributions.

理 解 ： Hypergeometric distribution; Negative binomial and geometric distributions; Poisson distribution and the Poisson process.

掌握：Binomial distribution.

【3】重点内容：

Binomial distribution.

【4】难点内容：

Poisson distribution and the Poisson process.

第 6 章：Some Continuous Probability Distribution （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】知识点：

（1）Continuous distributions.

（2）Uniform distribution; Normal distribution; Area under the normal curve; Applications of normal distribution.

（3）Normal approximation to the Binomial distribution.

（4）Exponential distribution.

【2】学习目标：

了解：Continuous distributions.

理解：Normal approximation to the Binomial distribution; Exponential distribution.

掌握： Uniform distribution; Normal distribution; Area under the normal curve; Applications of normal distribution.

【3】重点内容：

Applications of normal distribution.

【4】难点内容：

Exponential distribution.

第 7 章：Fundamental Sampling Distributions and Data Descriptions （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】知识点：

（1）Random sampling; Population and sample; Some important statistics.

（2）Sampling distributions; Sampling distribution of the mean.

（3）The Central Limit Theorem.

（4）Sampling distribution of S^2; F-distribution.

【2】学习目标：

了解：Sampling distribution of S^2; F-distribution.

理解：The Central Limit Theorem.

掌握：Random sampling; Population and sample; Some important statistics; Sampling distribution of the mean.

【3】重点内容：

Random sampling; Sampling distributions.

【4】难点内容：

Sampling distribution of the mean; Sampling distribution of S^2.

第 8 章：单样本和两样本的估计问题 （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】知识点：

（1）Statistical inference; Point and interval estimates.

（2）Estimating a mean; Confidence intervals; Standard error.

（3）Prediction intervals.

（4）Estimating the difference between two means; Paired observations.

（5）Estimating a proportion; Estimating the difference between two proportions.

（6）the variance; Estimating the ratio of two variances.

【2】学习目标：

了解：Statistical inference; Point and interval estimates.

理解：Confidence intervals; Standard error; Estimating the difference between two proportions; Estimating the ratio of two variances.

掌握：Estimating the difference between two means; Paired observations.

【3】重点内容：

Confidence intervals; Standard error.

【4】难点内容：

Estimating the difference between two means; Paired observations; Estimating the difference between two proportions; Estimating the ratio of two variances.

第 9 章：One- and Two-Sample Tests of Hypotheses （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】知识点：

（1）Statistical hypothesis.

（2）Hypothesis testing; Type I and Type II errors; P-values.

（3）Hypothesis test on a mean; Hypothesis test on two means.

（4）Choice of sample size.

（5）Hypothesis test on a proportion; Hypothesis test on two proportions.

（6）Hypothesis tests concerning variances.

（7）Hypothesis test for independence of categorical data.

【2】学习目标：

了解：Statistical hypothesis; Hypothesis test for independence of categorical data.

理解：Hypothesis testing; Type I and Type II errors; Hypothesis test on a proportion; Hypothesis test on two proportions; Hypothesis tests concerning variances.

掌握：Hypothesis test on a mean; Hypothesis test on two means; P-values; Choice of sample size.

【3】重点内容：

Hypothesis testing; Hypothesis test on two means; Choice of sample size.

【4】难点内容：

Hypothesis test on two proportions; Hypothesis tests concerning variances.

第 10 章：Simple Linear Regression and Correlation （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】知识点：

（1）Introduction to linear regression; The simple linear regression model.

（2）Least squares estimation; Properties of the Least square’s estimators.

（3）Inferences on regression coefficients; Prediction; Choice of regression model; Relation to correlation.

（4）Limitations of regression.

【2】学习目标：

了解：Introduction to linear regression; The simple linear regression model.

理解：Least squares estimation; Limitations of regression.

掌握：Properties of the Least square’s estimators; Inferences on regression coefficients; Prediction; Choice of regression model; Relation to correlation.

【3】重点内容：

Least squares estimation; Properties of the Least square’s estimators.

【4】难点内容：

Inferences on regression coefficients.

第 11 章：Analysis of Variance （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】知识点：

（1）Analysis of variance for linear regression.

（2）Analysis of variance.

（3）One-way ANOVA.

【2】学习目标：

了解：Analysis of variance.

理解：Analysis of variance for linear regression.

掌握：One-way ANOVA.

【3】重点内容：

Analysis of variance for linear regression.

【4】难点内容：

Source of Variation.

（二）实验教学

The Experiment Topic and class hour allocation related information for experimental teaching are shown in Table 2.

表 2 实验教学信息表

序号	实验项目名称	实验学时	每组人数	实验类型	实验性质
1	Introduction to R；Exploratory Data Analysis using the Boston Housing Dataset	2	4-6	Comprehen sive	Required
2	descriptively and graphically summarize several features of a dataset	2	4-6	Comprehen sive	Required
3	simple linear regression and its implementation in the modern computing language R.	2	4-6	Comprehen sive	Required
4	Random experimental design and result analysis	6	4-6	Comprehen sive	Required

实验项目一：Introduction to R；Exploratory Data Analysis using the Boston Housing Dataset （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】实验内容：

（1）Introduction to R.

（2）Data Analysis: Mean, Variance and Correlation.

【2】实验目的：

Learn to install and use The R Project for Statistical Computing; be able to do simple data analysis.

【3】教学要求：

Set appropriate questions, from simple to complex, by the students group experiment and give the analysis results.

【4】实验方式：

Laboratory, Computer, R, Jupyter.

【5】实验场地与设备：

Smart Classroom.

实验项目二：Data visualization （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】实验内容：

Descriptively and graphically the data relationship.

【2】实验目的：

Master popular data visualization methods.

【3】教学要求：

Visualize the given data set or optional data and give the correct description.

【4】实验方式：

Laboratory, Computer, R, Jupyter.

【5】实验场地与设备：

Smart Classroom.

实验项目三：Simple linear regression （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】实验内容：

Linear regression with R Software.

【2】实验目的：

Learn to use R Software to realize simple linear regression and make reasonable explanation.

【3】教学要求：

Show the steps and result analysis of simple linear regression.

【4】实验方式：

Laboratory, Computer, R, Jupyter.

【5】实验场地与设备：

Smart Classroom.

实验项目四：Random experimental design and result analysis （支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】实验内容：

Design and implement randomized experiments as required, collect experimental results, and conduct statistical analysis on the results. Independently complete experimental reports and insights.

【2】实验目的：

Problem oriented design of statistical experiments and interpretation of results.

【3】教学要求：

Organize and guide experimental activities effectively.

【4】实验方式：

Group research to collect data, Laboratory, Computer, R, Jupyter.

【5】实验场地与设备：

Campus, Smart Classroom.

五、教学安排与学时分配

The allocation of class hours is shown in Table 3.

表 3 学时分配表

讲课内容		学时				
		讲课	实验	上机	设计	课外
第 1 章	Introduction to Statistics and Data	4	0	0	0	0
第 2 章	Probability	4	0	0	0	0
第 3 章	Random Variables and Probability	4	0	0	0	0
第 4 章	Mathematical Expectation	4	0	0	0	0
第 5 章	Some Discrete Probability Distributions	4	2	0	0	0
第 6 章	Some Continuous Probability Distribution	4	6	0	0	0
第 7 章	Fundamental Sampling Distributions and	4	0	0	0	0
第 8 章	One- and Two-Sample Estimation	8	2	0	0	0
第 9 章	One- and Two-Sample Tests of	4	0	0	0	0
第 10 章	Simple Linear Regression and Correlation	4	2	0	0	0
第 11 章	Analysis of Variance	4	0	0	0	0
小计	-	48	12	0	0	0
总计	60					

六、教学方法

1、Multi-media-based lecturing.

2、Combining theory with industrial practical problems.

3、Knowledge delivery with ethic education.

七、成绩评定

1、Usual performance account for 20% of the total evaluation score, and are comprehensively evaluated based on students' classroom performance and homework completion.

2、Experimental results: Each group submits an experimental report for each experiment, with 6% of the total evaluation score for experiments 1, 2, and 3, and 12% for experiment 4.

3、The final exam includes all the contents introduced in this course. No one is allowed to take the related information by electronic means.

八、评价及持续改进

1、The subject coordinator shall be responsible for the syllabus discussion and improvement, and the revised version shall be submitted to deputy dean (teaching affairs) for reviewing then to executive dean for approvement.

2、The subject coordinator shall revise the syllabus based on the teaching content, effect and result distribution while optimize the assessment measures.

撰写：　王宪良

审核：　韩鹏

批准：　史文博

日期：　2023.7.15