量化管理导论 教学大纲

Introduction to Quantitative Management Subject Syllabus

一、课程信息 Subject Information

课程编号: Subject ID	3100313005	开课学期: Semester	1
课程分类: Category		所属课群: Section	学科基础类
课程学分: Credit Points	1	总学时/周: Total Hours/Weeks	16
理论学时: LECT. Hours	12	实验学时: EXP. Hours	4
PBL 学时: PBL Hours	0	实践学时/周: PRAC. Hours/Weeks	0
开课学院: College	东北大学 悉尼智能科技学院	适用专业: Stream	应用统计学 AS
课程属性: Pattern	必修 Compulsory	课程模式: Mode	互认 EQV
中方课程协调人: NEU Coordinator	张建波 Jianbo Zhang	成绩记载方式: Result Type	百分制 Marks
先修课程: Requisites	数学分析与建模		
英文参考教材: EN Textbooks	W L Winston, Operations Research: Applications and Algorithms, 4th edition, Thomson Learning Inc		
中文参考教材: CN Textbooks	运筹学:应用范例与解法.第 4 版（美）温斯顿 著，杨振凯 等译 清华大学出版社		
教学资源: Resources	数据、模型与决策.（第 12 版）伯纳德 W 泰勒著，侯文华，杨静蕾译 中国人民大学出版社 INTRODUCTION TO MANAGEMENT SCIENCE (Bernard W. Taylor)		
课程负责人(撰写人): Subject Director	于艳辉 Yanhui Yu	提交日期: Submitted Date	单击或点击此处输入日期。
任课教师(含负责人): Taught by	于艳辉 赵铁宇 张建波 Yanhui Yu, Tieyu Zhao, Jianbo Zhang		
审核人: Checked by	韩鹏	批准人: Approved by	史闻博
		批准日期: Approved Date	单击或点击此处输入日期。

二、教学目标 Subject Learning Objectives (SLOs)

注：毕业要求及指标点可参照悉尼学院本科生培养方案，可根据实际情况增减行数

Note: GA and index can be referred from undergraduate program in SSTC website. Please add/reduce lines based on subject.

<table>
<tr><td>整体目标:
Overall Objective</td><td colspan="2">量化管理导论是研究对人力、物力进行合理筹划和运用，寻找管理及决策最优化的综合性学科，是应用统计学专业的必修课。
为此，本课程主要学习线性规划、运输问题、整数规划、多阶段决策过程、非线性规划以及非确定决策问题，注重培养、提高学生在分析实际问题、解决实际问题，从而进一步建立数学模型的能力。相关数学软件的学习也是本门课程的学习重点，学生将理论问题与上机操作结合在一起，从而完成理论建模与利用软件计算得到结果的完整解题过程。
Introduction to quantitative management is a comprehensive subject that studies the rational planning and application of human and material resources, and seeks the optimization of management and decision-making. It is a required course for Applied Statistics.
Therefore, this course mainly studies linear programming, transportation problems, integer programming, multi-stage decision-making process problems, non-linear programming problems and uncertain decision-making problems. It focuses on training and improving students' ability to analyze and solve practical problems, so as to further establish mathematical models.
The learning of relevant mathematical software is also the focus of this course. Students combine theoretical problems with computer operation, so as to complete the complete process of theoretical modeling and software calculation.</td></tr>
<tr><td rowspan="3">（1）专业目标:
Professional Ability</td><td>1-1</td><td>掌握线性规划、运输问题、整数规划、多阶段决策过程问题、非线性规划问题以及非确定决策问题的运筹学模型，包括模型条件、结构特点、建模的基本方法步骤和应用范畴等。
Master the operational research models of linear programming, transportation problems, integer programming, multi-stage decision-making process problems, nonlinear programming problems and uncertain decision-making problems, including model conditions, structural characteristics, basic method steps and application scope.</td></tr>
<tr><td>1-2</td><td>通过对具体方法与模型的学习，认识运筹学在经营管理决策中作为提高决策水平的方法和工具的作用。了解其它相关的经营管理数量方法与模型以及发展方向。
Through the study of specific methods and models, we can understand the role of operational research as a method and tool to improve the level of decision-making in business management decision-making. Understand other related quantitative methods and models of operation and management and development direction.</td></tr>
<tr><td>1-3</td><td>以实际应用，提高学生分析问题、解决问题的科学素养。</td></tr>
</table>

		With practical application, improve students' scientific literacy of analyzing and solving problems.
	1-4	掌握相关的数学软件，并会利用其求解数学模型。 Master the relevant mathematical software, and use it to solve the mathematical model.
（2）德育目标: Essential Quality	2-1	了解我国历史上的量化管理思想，建立文化自信。 Understand the operational research thought in the history of China and establish cultural confidence
	2-2	认知量化管理理论可为我国发展建设提供决策指导。 Cognitive quantitative management theory can provide decision guidance for China's development and construction.

课程教学目标与毕业要求的对应关系 Matrix of GA & SLOs

毕业要求 GA	指标点 GA Index	教学目标 SLOs
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。 Science Knowledge: Apply knowledge of mathematics, natural science, fundamentals and an engineering specialization to the solution of complex engineering problems.	指标点 1-1：具有较强的演绎推理能力、准确计算能力、分析归纳能力、抽象思维能力，掌握数学、自然科学和相关专业知识，并使用其建立正确的数学、物理学等模型以解释复杂实际问题。 Capable of deductive reasoning, accurate calculation, analysis and induction and abstract thinking. Establishing correct mathematics, physics models with the professional knowledge of mathematics, natural science, etc. to solve complex practical problems.	1-1，1-2，2-2
	指标点 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。 Mastery the basic theories, knowledge and methods of applied statistics, such as statistical investigation, statistical data processing, statistical analysis, and the use of computers and statistical software; capable of data collecting, processing, and analyzing; familiar with the writing norms of pre-research reports, feasibility analysis reports, and research plans.	
2、设计/开发解决方案： 能够设计针对复杂实际问题的解决方案，设计满足特定需求的系统、单元或流程，并能够在设计环节中体现创新	指标点 2-1：能够对不同设计方案进行比较和优化，在工作各环节中具有创新意识和批判意识，善于发现、分析、系统表述和解决实际问题。 Capable of comparing and optimizing	1-3，1-4

意识，考虑社会、健康、安全、法律、文化以及环境等因素。 Design/Development of Solutions: Design solutions for complex practical problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, and safety, cultural, societal and environmental considerations.	different design schemes, having a sense of innovation and criticism in all aspects of work, and be good at discovering, analyzing, systematically elaborating and solving practical problems.	
	指标点 2-2：能够在设计和开发的各个环节中综合考虑社会、健康、安全、法律、文化以及环境等因素。 Able to comprehensively consider social, health, safety, legal, cultural, and environmental factors in all aspects of design and development.	1-3，1-4，2-2
3、研究：能够基于科学原理并采用科学方法对复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。 Investigation: Conduct investigations of complex problems using research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.	指标点 3-1：能够结合本专业知识对实验数据进行分析与解释，设计并优化实验方案，并通过信息综合得到合理有效的结论。 Capable of analyzing and interpreting the experimental data, designing and optimizing the experimental schemer with the knowledge of this stream; reasonable and effective conclusions are obtained through information synthesis.	1-4，2-1，2-2
	指标点 3-2：能够追踪国际前沿技术动态，掌握本专业涉及的重要技术指标以及达到指标所需的技术途径。 Capable of tracking the international cutting-edge technology trends; mastery of the important technical indicators involved in the stream and the technical approaches required to achieve the indicators.	

三、教学内容 Content (Topics)

注：以中英文填写，各部分内容的表格可根据实际知识单元数量进行复制、扩展或缩减

Note: Filled in both CN and EN, extend or reduce based on the actual numbers of knowledge unit

(1) 理论教学 Lecture

知识单元序号: Knowledge Unit No.	1	支撑教学目标: SLOs Supported	1-1，1-2，1-3，1-4
知识单元名称 Unit Title	量化管理简介 Introduction to quantitative management		
知识点: Knowledge Delivery	释义与发展简史 A brief history of interpretation and development		
	研究的基本方法 The Seven-Step Model-Building Process		
	简单线性规划（LP）模型与实例 Modeling examples		

学习目标: Learning Objectives	了解: Recognize	释义与发展简史 A brief history of interpretation and development
	理解: Understand	简单线性规划（LP）模型与实例 Simple linear programming model and examples
	掌握: Master	研究的基本方法 The Seven-Step Model-Building Process
德育目标 Moral Objectives	使学生了解我国古代的量化管理思想，建立民族文化自信；在处理建模的实际问题中，结合环保、能源节约意识等方面。 In order to make students understand the quantitative management thought of ancient China and establish the self-confidence of national culture, we can combine the education of environmental protection, energy conservation and other aspects in the practical problems of modeling.	
重点: Key Points	研究的基本方法 The Seven-Step Model-Building Process	
难点: Focal points	简单线性规划（LP）模型与实例 Simple linear programming model and examples	

知识单元序号: Knowledge Unit No.	2	支撑教学目标: SLOs Supported	1-1，1-2，1-3，1-4
知识单元名称 Unit Title	复杂建模实例，线性规划图解法 Complex modeling examples, linear programming graphical method		
知识点: Knowledge Delivery	线性规划图解法 The linear programming graphical method		
	建模实例 Linear programming: modeling examples		
	运输问题 Transportation problem		
学习目标: Learning Objectives	了解: Recognize	运输问题解法 Solution of transportation problem	
	理解: Understand	建模实例 Linear programming: modeling examples	
	掌握: Master	线性规划图解法 The linear programming graphical method	
德育目标 Moral Objectives	结合当前我国运输业的飞速发展，在高铁、桥梁等建设方面取得的非凡成就，提高学生的民族自豪感。 Combined with the rapid development of China's transportation industry, we have made remarkable achievements in the construction of high-speed railway and bridges to enhance our national pride.		
重点: Key Points	线性规划问题的建模 Modeling and solving of linear programming problems		
难点: Focal points	运输问题 Transportation problem		

知识单元序号: Knowledge Unit No.	3	支撑教学目标: SLOs Supported	1-1，1-2，1-3，1-4
知识单元名称 Unit Title	整数规划模型 Integer programming models		

知识点: Knowledge Delivery	纯整数规划模型 Pure integer programming model	
	混合整数规划模型 Mixed integer programming model	
	0-1 整数规划模型 0-1 integer programming model	
学习目标: Learning Objectives	了解: Recognize	整数规划模型的特点 Features of integer programming model
	理解: Understand	模型之间的差异和联系 Differences and connections between models
	掌握: Master	模型建立与求解 Model establishment and solution
德育目标 Moral Objectives	引导大学生信以立志、信以守身、信以处事、信以待人，从身边的事情做起，从具体的事情做起，使他们形成正确的竞争观念，具有助人为乐、团结协作的精神，确立诚信受益的成长方向。 We should guide college students to be faithful and determined, to keep their body, to handle affairs, and to treat others with faith. We should start from the things around us and from the specific things, so that they can form a correct concept of competition, have the spirit of helping others, unite and cooperate, and establish the growth direction of honesty and benefit.	
重点: Key Points	掌握整数规划模型的运用 Master the use of integer programming models	
难点: Focal points	整数规划模型的求解 Solution of integer programming model	

知识单元序号: Knowledge Unit No.	4	支撑教学目标: SLOs Supported	1-1，1-2，1-3，1-4
知识单元名称 Unit Title	非线性规划模型 Non-linear programming models		
知识点: Knowledge Delivery	非线性规划的数学模型 Mathematical model of nonlinear programming		
	局部极值和全局极值 Local extremum and global extremum		
	凸规划的定义和特点 Definition and characteristics of convex programming		
学习目标: Learning Objectives	了解: Recognize	非线性规划模型与线性规划模型的区别 The difference between nonlinear programming model and linear programming model	
	理解: Understand	无约束问题的最优条件 Optimal conditions for unconstrained problems	
	掌握: Master	模型建立与求解 Model establishment and solution	
德育目标 Moral Objectives	使大学生形成良好的个性心理品质，具备社会适应能力、承受挫折能力和情绪调节能力，使他们的心理素质与思想道德素质、科学文化素质和身体素质全面协调发展，保持对生活的积极状态。 To enable college students to form a good personality and psychological quality, have the ability to adapt to the society, the		

	ability to withstand frustration, and the ability to adjust emotions, so that their psychological, ideological, moral, scientific, cultural, and physical quality can develop in a coordinated manner and maintain a positive state of life.
重点: Key Points	非线性规划模型的应用 Application of nonlinear programming model
难点: Focal points	凸函数、凸规划的定义与判断 Convex function, definition and judgment of convex programming

知识单元序号: Knowledge Unit No.	5	支撑教学目标: SLOs Supported	1-1，1-3
知识单元名称 Unit Title	MATLAB 软件及其基本使用方法 MATLAB and its basic usage		
知识点: Knowledge Delivery	MATLAB 软件介绍 Introduction of MATLAB		
	数据的表示及运算 The expression and operation of data		
	矩阵(向量)的生成、修改与基本运算 Generation, modification and operation of matrix (vector)		
学习目标: Learning Objectives	了解: Recognize	MATLAB 软件介绍的特点及功能 MATLAB and its characters and functions	
	理解: Understand	数据的表示及运算 The expression and operation of data	
	掌握: Master	矩阵(向量)的生成、修改与基本运算 Generation, modification and operation of matrix (vector)	
德育目标 Moral Objectives	引导学生具有团结合作、共同创新的精神，并提高他们的动手能力。 We should guide students to have the spirit of helping others, uniting and cooperation, and improve them the hands-on ability.		
重点: Key Points	数据的表示及运算 The expression and operation of data		
难点: Focal points	矩阵(向量)的生成、修改与基本运算 Generation, modification and operation of matrix (vector)		

知识单元序号: Knowledge Unit No.	6	支撑教学目标: SLOs Supported	1-1，1-3
知识单元名称 Unit Title	优化问题的 MATLAB 求解 The solution of optimization problems using MATLAB		
知识点: Knowledge Delivery	用 MATLAB 解决优化问题的一般步骤 General steps to solve optimization problems by MATLAB		
	线性规划 (一般线性规划、整数规划、0-1 规划) 问题的 MATLAB 求解 The solution of linear programming problems (common linear programming, integer programming, 0-1 programming) using MATLAB		

	非线性规划(无约束优化、单/多变量约束优化)问题的 MATLAB 求解 The solution of nonlinear programming problems (unconstrained optimization, univariate / multivariate constrained optimization) using MATLAB	
学习目标: Learning Objectives	了解: Recognize	用 MATLAB 解决优化问题的一般步骤 General steps to solve optimization problems by MATLAB
	理解: Understand	线性规划 (一般线性规划、整数规划、0-1 规划) 问题的 MATLAB 求解 The solution of linear programming problems (common linear programming, integer programming, 0-1 programming) using MATLAB
	掌握: Master	非线性规划(无约束优化、单/多变量约束优化)问题的 MATLAB 求解 The solution of nonlinear programming problems (unconstrained optimization, univariate / multivariate constrained optimization) using MATLAB
德育目标 Moral Objectives	引导学生具有团结合作、共同创新的精神，并提高他们的动手能力。 We should guide students to have the spirit of helping others, uniting and cooperation, and improve them the hands-on ability.	
重点: Key Points	线性规划 (一般线性规划、整数规划、0-1 规划) 问题的 MATLAB 求解 The solution of linear programming problems (common linear programming, integer programming, 0-1 programming) using MATLAB	
难点: Focal points	非线性规划(无约束优化、单/多变量约束优化)问题的 MATLAB 求解 The solution of nonlinear programming problems (unconstrained optimization, univariate / multivariate constrained optimization) using MATLAB	

(2)实验教学 Experiments

注：可根据实际情况增减行数。实验类型可分为验证性、设计性、综合性，实验性质可分为选做、必做。

Note: Please add/reduce lines based on subject. The Type contains Verify, Design, and Comprehensive, while the Pattern contains Required and Elective

序号 No.	实验项目名称 Experiment Topic	学时 Hours	每组人数 MPG*	实验类型 Type	实验性质 Pattern
1	矩阵（向量）的生成、修改、基本运算 Generation, modification and basic operations of Matrix (vector)	2	1	验证性 Verify	必做 Elec

2	线性规划问题、非线性规划问题 Linear programming problem, Non-linear programming problem	2	1	验证性 Verify	必做 Elec
	总计 Total	4			

*MPG: Members per group

实验项目序号: Experiment No.	1	支撑教学目标: SLOs Supported	1-1，1-3
每组成员: Members per Group	1	指导教师: Tutor	张建波 Jianbo Zhang
实验名称: Experiment Title	常见的线性规划问题 Linear programming modeling		
实验内容: Content	一般线性规划问题的求解 Solving of simple linear programming		
	整数规划问题的求解 Solving of integer programming		
	0-1 规划问题的求解 Solving of binary programming		
学习目标: Learning Objectives	掌握常见的线性规划问题的求解方法 Master the steps of solving linear programming modeling		
教学要求: Requirements	对给定的问题，学习求解线性规划模型的一般步骤。 Given the inear programming problems, learn and master the steps to solve the problem in Matlab and Lingo respectively.		
实验场地: Location	实验室/机房 （科技楼 5078） Computer room 5078		
实验软硬件设备: Software/Hardware	计算机 Computer		

实验项目序号: Experiment No.	2	支撑教学目标: SLOs Supported	1-1，1-3
每组成员: Members per Group	1	指导教师: Tutor	张建波 Jianbo Zhang
实验名称: Experiment Title	常见的非线性规划问题 Non-linear programming modeling		
实验内容: Content	非线性规划的数学模型 Method to solving nonlinear programming modeling		
学习目标: Learning Objectives	掌握数学软件解决非线性规划的一般步骤 Master the steps to solving non-linear programming modeling		
教学要求: Requirements	对给定的问题，学习求解非线性规划模型的一般步骤。 Given the non-linear programming problems, learn and master the steps to solve the problem in Matlab and Lingo respectively.		

实验场地: Location	实验室/机房 （科技楼 5078） Computer room 5078
实验软硬件设备: Software/Hardware	计算机 Computer

四、教学安排 Teaching Schedule

注：可根据实际情况增减行数

Note: Please add/reduce lines based on subject.

教学内容 Teaching Content	学时(周) Hour(Week)			
	理论 LECT.	实验 EXP.	课外实践 PBL	集中实践 PRAC.
量化管理导论发展简史，研究的基本特征与基本方法；简单线性规划模型与实例 Introduction to quantitative management: a brief history of development, basic characteristics and methods of research, simple linear programming model and examples	2			
复杂建模实例，线性规划图解法 Complex modeling examples, linear programming graphical method	2			
整数规划的一般形式及应用 General form and application of integer programming	2			
介绍非线性规划及非线性规划模型 Introduction of nonlinear programming and nonlinear programming model	2			
MATLAB 软件及其基本使用方法 MATLAB and its basic usage	2	2		
优化问题的 MATLAB 求解 The solution of optimization problems using MATLAB	2	2		
总计 Total	12	4	0	0

五、教学方法 Teaching Methodology

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

勾选 Check	教学方法与特色 Teaching Methodology & Characters
☑	多媒体教学：基于信息化设备的课堂教学 Multi-media-based lecturing
☑	实践能力传授：理论与行业、实际案例相结合

	Combining theory with industrial practical problems
☑	课程思政建设：知识讲授与德育相结合 Knowledge delivery with ethic education
☑	PBL 教学：问题驱动的分组学习与交流 Problem-based learning
☐	其他:单击或点击此处输入文字。 Other:单击或点击此处输入文字。

六、成绩评定 Assessment

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

考核环节: Assessment Content	平时 Behavior	环节负责人: Director	赵铁宇 Tieyu zhao
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	30
考核方式: Measures	满分 100 分，使用“学习通”记录学生平时的课堂表现，每次考勤计 10 分，缺勤不得分，缺勤五次及以上取消考试资格。每次作业计 10 分，抄袭、给他人抄袭或未交作业不得分。最后总分不超过 100 分，不低于 0 分。 The full score is 100 points. Students' usual classroom performance is recorded by "learning pass". 10 points are counted for each attendance, and no score is given for absence. The examination qualification is cancelled for five or more absences. 10 points for each assignment, no score for plagiarism, plagiarism for others or no assignment. The final total score is not more than 100 points, not less than 0 points		

考核环节: Assessment Content	实验 Experiment	环节负责人: Director	张建波 Jianbo Zhang
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	30
考核方式: Measures	实验：满分 100 分，实验成绩不及格（低于 60 分）不得参加期末考试。通过课堂表现及实验报告记录学生成绩，每次考勤计 10 分，缺勤不得分。每次实验计 40 分。抄袭、给他人抄袭或未交实验报告不得分。		

考核环节: Assessment Content	期末 Final	环节负责人: Director	于艳辉 Yanhui Yu
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	40

考核方式: Measures	满分 100 分，通过批阅期末考试试卷给出学生成绩。 The full score is 100, and the students' scores are given by marking the final examination papers.

七、改进机制 Improvement Mechanism

注：未尽事宜以教学团队以及学院教学指导委员会商定为准。

Note: Matters not covered in this file shall be determined by TAB of SSTC, NEU.

教学大纲改进机制 Subject Syllabus Improvement Mechanism			
考核周期(年): Check Period (YR)	4	修订周期(年): Revise Period (YR)	4
改进措施: Measures	课程负责人根据课程教学内容与人才培养目标组织课程团队讨论并修改教学大纲，报分管教学工作副院长审核后由执行院长批准。 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.		
成绩评定改进机制 Assessment Improvement Mechanism			
考核周期(年): Check Period (YR)	1	修订周期(年): Revise Period (YR)	1
改进措施: Measures	课程负责人根据课程教学内容、课堂教学效果以及成绩分布，对课程教学方法和成绩评定环节进行改进，并同步优化评定办法。 The subject coordinator shall revise the syllabus based on the teaching content, effect and result distribution while optimize the assessment measures.		