量化管理优化技术 教学大纲

Quantitative Management　Subject Syllabus

一、课程信息 Subject Information

课程编号: Subject ID	3100313005	开课学期: Semester	4
课程分类: Category	专业教育 PA	所属课群: Section	专业基础 MF
课程学分: Credit Points	3.5	总学时/周: Total Hours/Weeks	56
理论学时: LECT. Hours	48	实验学时: EXP. Hours	8
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	引进 UTS
中方课程协调人: NEU Coordinator	赵铁宇 Tieyu Zhao	成绩记载方式: Result Type	百分制 Marks
先修课程: Requisites	高等数学建模 Advanced Mathematical Modeling		
英文参考教材: EN Textbooks	Wayne L. Winston., Operations research:applications and algorithms. PWS-Kent Pub. Co.		
中文参考教材: CN Textbooks	胡运权，密码学教程（第五版），清华大学出版社，2018.		
教学资源: Resources	https://lms.cloudcampus.com.cn/courses/61		
课程负责人(撰写人): Subject Director	赵铁宇 Tieyu Zhao	提交日期: Submitted Date	4/9/2023
任课教师(含负责人): Taught by	赵铁宇　　Julia Memar Tieyu Zhao　　Julia Memar		
审核人: Checked by	韩鹏	批准人: Approved by	史闻博
		批准日期: Approved Date	4/9/2023

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.

整体目标: Overall Objective		《量化管理优化》是应用统计学专业重要的专业基础课程之一。通过本课程的学习，使学生掌握运筹学各主要分支的模型、基本概念与理论、主要算法和应用，从而为学生进一步从事该方向的学习与研究工作打下坚实的基础，并能使学生在相关部门的学习实践中提高解决实际问题的能力。 Optimization in Quantitative Management is one of the important professional basic courses of students majoring in Statistics. Through the study of this course, students can master the models, basic concepts and theories, main algorithms and applications of the main branches of operations research, so as to lay a solid foundation for students to further engage in the study and research of this direction, and improve their ability to solve practical problems in the learning and Practice of relevant departments.
（1）专业目标: Professional Ability	1-1	具有建立及求解线性规划模型的能力 Have the ability to establish and solve linear programming model
	1-2	掌握线性规划的求解方法，单纯形法 Master the solution method of linear programming, simplex method
	1-3	具有分析问题及应用灵敏度分析的能力 Ability to analyze problems and apply sensitivity analysis
	1-4	掌握运输问题的数学模型及表上作业法 Master the mathematical model and table operation method of transportation problems
	1-5	掌握整数规划的模型建立及求解方法 Master the model establishment and solution method of integer programming
	1-6	具备 0-1 整数规划的求解能力 Have the ability to solve 0-1 integer programming
	1-7	掌握非线性规划模型的建立及求解 Master the establishment and solution of nonlinear programming model
（2）德育目标: Essential Quality	2-1	培养遵守法律、懂规则、守规则的新时代公民 Cultivate citizens of the new era who abide by the law, understand and obey the rules
	2-2	了解主要矛盾和次要矛盾,在面对复杂问题的时候要实事求是、抓住主要矛盾 Understand the main contradiction and secondary contradiction, seek truth from facts and grasp the main contradiction in the face of complex problems
	2-3	培养服务意识，具有"以人为本"的服务精神 Cultivate service consciousness and have the service spirit of

		"people-oriented"
	2-4	培养具有不畏困难、不惧失败、锲而不舍、敢于尝试、迎难而上的精神,并在学习过程中培养自己的细心和耐心的勇气和精神 Cultivate the spirit of not fearing difficulties or failure, perseverance, daring to try, and cultivate their own careful and patient courage and spirit in the process of learning
	2-5	培养有条理和计划,做到心中有数、有条不紊、循序渐进地完成一项工作 Cultivate a sense of order and plan, and complete a work in an orderly and gradual manner

<table>
<tr><th colspan="3">课程教学目标与毕业要求的对应关系 Matrix of GA & SLOs</th></tr>
<tr><th>毕业要求 GA</th><th>指标点 GA Index</th><th>教学目标 SLOs</th></tr>
<tr>
<td rowspan="2">3、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意识,考虑社会、健康、安全、法律、文化以及环境等因素
3. 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.</td>
<td>3-1:能够设计针对本专业相关复杂实际问题的解决方案
3-1: Capable of designing solutions to complex practical problems related to this major</td>
<td rowspan="2">1-1 到 1-7</td>
</tr>
<tr>
<td>3-2: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
3-2: Capable of comparing and optimizing 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</td>
</tr>
<tr>
<td rowspan="2">5、使用现代工具:能够针对复杂实际问题,开发、选择与使用恰当的技术、资源、现代信息技术工具,包括对复杂实际问题的预测与模拟,并能够理解其局限性
5. Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex practical problems, with an</td>
<td>5-2 熟悉解决本专业相关复杂实际问题所需的技术和资源,能够运用现代信息技术进行文献检索和资料查询,获取专业解决方案
5-2: Familiar with the technology and resources required to solve complex practical problems related to the major, capable of using modern information technology to conduct document retrieval and data query, and obtaining professional solutions</td>
<td rowspan="2">1-1 到 1-7</td>
</tr>
<tr>
<td>5-3:能够针对本专业相关复杂实际问题,选择与使用恰当的技术、资源、现代信息技术工具</td>
</tr>
</table>

understanding of the limitations	5-3: Capable of selecting and using appropriate technology, resources, and modern information technology tools in response to complex practical problems related to the major	

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、2-4
知识单元名称 Unit Title	线性规划模型建立及求解 Linear programming model establishment and solution			
知识点: Knowledge Delivery	线性规划数学模型，及求解方法 Linear programming mathematical model and solution method			
学习目标: Learning Objectives	了解: Recognize	图解法 Graphical method		
	理解: Understand	线性规划的一般形式，标准形式 General form of linear programming, standard form		
	掌握: Master	线性规划的求解，单纯形法，灵敏度分析 Basic steps of Regression Analysis		
德育目标 Moral Objectives	培养具有不畏困难、不惧失败、锲而不舍、敢于尝试、迎难而上的精神，并在学习过程中培养自己的细心和耐心的勇气和精神 Cultivate the spirit of not fearing difficulties or failure, perseverance, daring to try, and cultivate their own careful and patient courage and spirit in the process of learning			
	培养服务意识，具有"以人为本"的服务精神 Cultivate service consciousness and have the service spirit of "people-oriented"			
	培养遵守法律、懂规则、守规则的新时代公民 Cultivate citizens of the new era who abide by the law, understand and obey the rules			
重点: Key Points	单纯形法，对偶单纯形法，灵敏度分析 Simplex Method, Dual Simplex Method, Sensitivity Analysis			
	线性规划数学模型的建立 Establishment of Linear Programming Mathematical Model			
难点: Focal Points	单纯形法，灵敏度分析 Simplex Method, Sensitivity Analysis			

知识单元序号: Knowledge Unit No.	2		支撑教学目标: SLOs Supported	1-2，2-2
知识单元名称 Unit Title	非线性规划模型建立及求解 Building and Solving Nonlinear Programming Models			
知识点: Knowledge Delivery	基本概念 basic concept			
	非线性规划数学模型的表达式 Expressions of Nonlinear Programming Mathematical Models			
	无约束极值问题 Unconstrained Extreme Value Problem			
	约束极值问题 Constrained Extreme Value Problem			
学习目标: Learning Objectives	了解: Recognize	基本概念 basic concept		
	理解: Understand	非线性规划数学模型 Nonlinear Programming Mathematical Model		
	掌握: Master	一维搜索，非线性规划的求解 One-dimensional search, solving of nonlinear programming		
德育目标 Moral Objectives	了解主要矛盾和次要矛盾，在面对复杂问题的时候要实事求是、抓住主要矛盾 Understand the main contradiction and secondary contradiction, seek truth from facts and grasp the main contradiction in the face of complex problems			
重点: Key Points	非线性规划的求解 Solving Nonlinear Programming			
难点: Focal points	约束极值问题 Constrained Extreme Value Problem			

知识单元序号: Knowledge Unit No.	3		支撑教学目标: SLOs Supported	1-3，2-5
知识单元名称 Unit Title	整数规划的数学模型及求解 Mathematical Model and Solution of Integer Programming			
知识点: Knowledge Delivery	基本概念 basic concept			
	整数规划的分类 Classification of Integer Programming			
	分支定界法 branch and bound			
	0-1 整数规划 0-1 integer programming			
	匈牙利解法 Hungarian solution			

	了解:	整数规划的分类
学习目标:	Recognize	Classification of Integer Programming
Learning Objectives	理解:	整数规划的数学模型
	Understand	Mathematical Model of Integer Programming
	掌握:	整数规划的求解
	Master	Solving Integer Programming
德育目标 Moral Objectives	培养有条理和计划，做到心中有数、有条不紊、循序渐进地完成一项工作 Cultivate a sense of order and plan, and complete a work in an orderly and gradual manner	
重点: Key Points	模型的建立与求解 Model establishment and solution	
难点: Focal points	分支定界法；匈牙利法 Branch and Bound Law; Hungarian Law	

(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	线性规划的求解（一） Solving Linear Programming I	2	1	验证性 Verify	必做 Elec
2	线性规划的求解（二） Solving Linear Programming II	2	1	验证性 Verify	必做 Elec
3	非线性规划的求解 Solving Nonlinear Programming	2	1	验证性 Verify	必做 Elec
4	整数规划的求解 Solving Integer Programming	2	1	验证性 Verify	必做 Elec
	总计 Total	8			

*MPG: Members per group

实验项目序号: Experiment No.	1	支撑教学目标: SLOs Supported	1-2, 1-3
每组成员: Members per Group	1	指导教师: Tutor	赵铁宇 Tieyu Zhao
实验名称: Experiment Title	线性规划的求解（一） Solving Linear Programming I		
实验内容: Content	建立简单线性规划模型 Building a Simple Linear Programming Model		

学习目标: Learning Objectives	掌握基本的 lingo,Matlab 语句 Master the basic lingo and Matlab statements
教学要求: Requirements	对给定的问题，学习求解简单线性规划模型的基本步骤。 Learn the basic steps for solving a simple linear programming model for a given problem.
实验场地: Location	实验室/机房 （科技楼 6061） Computer room 6061
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	1-2, 1-3
每组成员: Members per Group	1	指导教师: Tutor	赵铁宇 Tieyu Zhao
实验名称: Experiment Title	线性规划的求解（二） Solving Linear Programming II		
实验内容: Content	对给定模型使用 Lingo,Matlab 求解 Solve the given model using Lingo, Matlab		
学习目标: Learning Objectives	掌握 Lingo,Matlab 求解线性规划模型 Master Lingo, Matlab to solve linear programming model		
教学要求: Requirements	对给定的问题，会通过软件进行求解及灵敏度分析。 For a given problem, the solution and sensitivity analysis will be performed through the software.		
实验场地: Location	实验室/机房 （科技楼 6061） Computer room 6061		
实验软硬件设备: Software/Hardware	计算机 Computer		

实验项目序号: Experiment No.	3	支撑教学目标: SLOs Supported	1-4
每组成员: Members per Group	1	指导教师: Tutor	赵铁宇 Tieyu Zhao
实验名称: Experiment Title	非线性规划的求解 Solving Nonlinear Programming		
实验内容: Content	熟悉基本命令 Get familiar with basic commands		
	一维搜索求解 one-dimensional search solution		
	无约束极值问题求解 Solving Unconstrained Extreme Value Problems		
	约束极值问题求解 Solving Constrained Extreme Value Problems		
学习目标:	掌握使用 Lingo,Matlab 求解非线性规划问题的方法		

Learning Objectives	Master the method of using Lingo and Matlab to solve nonlinear programming problems
教学要求: Requirements	对给定数学模型会使用软件进行求解 A given mathematical model is solved using software
实验场地: Location	实验室/机房 （科技楼 6061） Computer room 6061
实验软硬件设备: Software/Hardware	计算机 Computer

实验项目序号: Experiment No.	4	支撑教学目标: SLOs Supported	1-4
每组成员: Members per Group	1	指导教师: Tutor	赵铁宇 Tieyu Zhao
实验名称: Experiment Title	整数规划的求解 Solving Integer Programming		
实验内容: Content	整数规划的数学模型 Mathematical Model of Integer Programming		
	Lingo,Matlab 求解整数规划的基本命令 Lingo,Matlab basic commands for solving integer programming		
	0-1 整数规划的求解 Solving the 0-1 Integer Programming		
	匈牙利解法 Hungarian solution		
学习目标: Learning Objectives	学会 Lingo,Matlab 求解整数规划 Learn Lingo, Matlab to solve integer programming		
教学要求: Requirements	会使用软件进行整数规划的求解 Use software to solve integer programming		
实验场地: Location	实验室/机房 （科技楼 6061） Computer room 6061		
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.
线性规划基本概念 Introduction to Regression Analysis	28	4		

线性规划建模及求解 Statistics review				
非线性规划建模及求解 Simple Linear Regression	8	2		
整数规划建模及求解 Multiple Linear Regression	12	2		
总计 Total	48	8		

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 (%)	20
考核方式: Measures	满分 100 分，使用"学习通"进行。出勤，50 分；作业，50 分。 The full score is 100 points. Students' usual classroom performance is recorded by "XueXiTong". 5 points are counted for each attendance, and no score is given for absence. And 5 points are counted 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	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，共 4 次上机实验课，每次课需要提交一个报告，每次报告 25 分。 The full score is 100 points. There are 4 computer experiment classes in total. Each class needs to submit a report, with 25 points for each report.		

考核环节: Assessment Content	期末 Final	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 (%)	50
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 approval		
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.		