算法设计与分析 课程教学大纲

The Design and Analysis of Algorithm **Subject Syllabus**

一、课程信息 Subject Information

课程编号: Subject ID	3100213012.01	开课学期: Semester	4
课程分类: Category	专业教育 PA	所属课群: Section	专业平台 MT
课程学分: Credit Points	2.5	总学时/周: Total Hours/Weeks	40/4
理论学时: LECT. Hours	40	实验学时: EXP. Hours	0
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 Sydney Smart Technology College Northeastern University	适用专业: Stream	计算机科学与技术 CST
课程属性: Pattern	选修 Elective	课程模式: Mode	自建 NEU
中方课程协调人: NEU Coordinator	宋欣 Xin Song	成绩记载方式: Result Type	百分制 Marks
先修课程: Requisites	程序设计基础,数据结构 Foundation of Programming, Data Structure		
英文参考教材: EN Textbooks	Jon Kleinberg, Algorithm design, 人民邮电出版社,2019		
中文参考教材: CN Textbooks	王晓东,计算机算法设计与分析(第5版),电子工业出版社,2018. Wang Xiaodong. Computer Algorithm (5th Edition).Electronics Industry.2018		
教学资源: Resources	课程教学群分享知识点视频讲解 https://www.icourses.cn/sCourse/course_2535.html		
课程负责人(撰写人): SubjectDirector	宋欣	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	宋欣		
审核人: Checked by	韩鹏	批准人: Approvedby	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.

整体目标: Overall Objective		课程的主要目标是培养具有扎实的算法设计和分析的理论基础，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和具备良好的团队合作能力的程序设计人才。算法设计与分析课程是学生学习高级计算机应用和科学知识的入门课程，学生通过本门课程的理论学习和实践活动能应用算法设计与分析知识解决软件开发应用问题，包括操作系统、数据库和计算机网络等各个计算机应用领域。通过团队合作，学生能了解并掌握计算机算法表示方法，问题的解决与优化策略，通过对典型算法程序的调试和测试，逐步具备分析复杂问题的能力。 The major aims to cultivate designing and analyzing ability of fundamental computer algorithm theory, having correct values and sense of social responsibility, good professional ethics and conduct, and capable of good teamwork. This is an introductory algorithm subject to high-Level computer application and computer science, Upon successful completion of this subject student should be able to design and analysis algorithm to solve software development application problems related to operation system, database, network and so on. As project team members would, students go through the computer algorithm representing method, incorporating analysis of complex problems, programming solution design, implementation in computer language and programming, debugging and testing.
（1）专业目标: Professional Ability	1-1	掌握基本的算法设计策略，如递归与分治，动态规划，贪心策略，回溯，分支限界法，随机化算法等。Mastery of the design strategy of computer algorithms such as recursion，divide and conquer，dynamic programming, greedy, backtrack, branch and bound method, randomization and so on.
	1-2	掌握算法复杂度分析方法，能分析和预估计算机程序的执行效率。Mastery of the analysis application of algorithm complexity, students should be able to identify and explain the workings efficiency of computer program.
	1-3	拥有符合本专业行业需求预期的计算机算法设计与分析能力。Students should be able to demonstrate the understanding and the ability to follow algorithm design and analysis capacity to align with industry expectations
	1-4	具备良好的沟通和团队合作能力，能应用算法设计与分析知识解决较复杂的实际问题。Students should be able to communicate effectively and collaborate as a team member to solve complex problems using algorithm design and analysis knowledges.
（2）德育目标: Essential Quality	2-1	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

		Having correct values and sense of social responsibility, good professional ethics and conduct
	2-2	具有优异的创新精神和终身学习能力,学习与运用新技术的能力突出，能够适应持续的环境变化与技术变革 Having innovation spirit and ability of lifelong learning, learning and applying new technologies, and be able to adapt to continuous environmental changes and technological changes
	2-3	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 Havingstrong belief of "Integrate east and west, innovate for the long-term development", NEU character of "Striving constantly for improvement and behaving in conformity with truth"
	2-4	厚植爱国爱民、勇担责任的家国情怀，锻造坚忍不拔、创新进取的工匠精神 Having the spirit of patriotism, perseverance, innovation, and enterprising
	2-5	具有良好的跨文化、跨领域沟通交流能力 Good cross-cultural and cross-field communication skills

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
毕业要求 1 **GA1**	指标点 1-2	PA1-1,PA1-2,EQ2-1
	指标点 1-3	PA1-3, EQ2-2
毕业要求 2 **GA2**	指标点 2-1	PA1-4, EQ2-4
	指标点 2-2	PA1-4, EQ2-4
毕业要求 3 **GA3**	指标点 3-1	PA1-4, EQ2-4
	指标点 3-3	PA1-2, EQ2-1
毕业要求 5 **GA5**	指标点 5-1	PA1-2, EQ2-3
	指标点 5-3	PA1-2, EQ2-2, EQ2-3
毕业要求 9 **GA9**	指标点 9-1	PA1-4, EQ2-4
	指标点 9-2	EQ2-5
毕业要求 10 **GA10**	指标点 10-1	PA1-3, PA1-4, EQ2-5
毕业要求 12 **GA12**	指标点 12-1	PA1-3, EQ2-2
	指标点 12-2	PA1-3, EQ2-2

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	PA1-1,PA1-2,EQ2-4
知识单元名称 Unit Title	计算机算法概述 Introduction to Computer Algorithm			
知识点: Knowledge Delivery	算法与程序 Algorithm and Program			
	算法复杂性分析 Algorithm Complexity Analysis			
	NP 完全性理论 Theory of NP-completeness			
学习目标: Learning Objectives	了解: Recognize	计算机算法的历史和发展 History and Development of Computer Algorithm		
	理解: Understand	算法的概念和特点 Concept and Characteristic of Algorithms		
	掌握: Master	计算机算法的描述，算法复杂度分析 Description of Computer Algorithm， Algorithm Complexity Analysis		
德育目标 Moral Objectives	厚植爱国爱民、勇担责任的家国情怀，锻造坚忍不拔、创新进取的工匠精神 Having the spirit of patriotism, perseverance, innovation, and enterprising			
重点: Key Points	算法的概念、特性、描述方法，算法复杂性分析 The Concept and Characteristicof Algorithm, Description Method of Algorithm Algorithm Complexity Analysis			
难点: Focal points	算法的概念、特性、描述方法，算法复杂性分析 The Concept and Characteristicof Algorithm, Description Method of Algorithm Algorithm Complexity Analysis			

知识单元序号: Knowledge Unit No.	2		支撑教学目标: SLOs Supported	PA1-1,PA1-2,EQ2-3
知识单元名称 Unit Title	递归与分治策略 Recursion and Divide-and-Conquer Strategies			
知识点: Knowledge Delivery	递归的概念 The Concept of Recursion 分治法的基本思想 The Basic Idea of Divide-and-Conquer			
	二分搜索技术 Binary Search Technique 大整数的乘法 Multiplication of large integers Strassen 矩阵乘法 matrix multiplication of strassen			
	棋盘覆盖 Chessboard Cover 合并排序 merge sort 快速排序 Quicksort			
	线性时间选择 Linear time selection 最接近点对问题 Closest pair of points problem 循环赛日程表 Round-robin schedule			
学习目标: Learning Objectives	了解: Recognize	子问题，递归的概念 Sub-problem，The Concept of Recursion		
	理解: Understand	典型的递归结构，分治算法思想， 二分搜索技术，合并排序，快速排序，循环赛日程表 The construction of a typical Recursion, The Basic Idea of Divide-and-Conquer，Binary Search Technique，merge sort，Quicksort，Round-robin schedule		
	掌握: Master	大整数的乘法，Strassen 矩阵乘法，棋盘覆盖，线性时间选择，最接近点对问题 Multiplication of large integers，matrix multiplication of Strassen，Chessboard Cover，Linear time selection，Closest Pair of Points Problem		
德育目标 Moral Objectives	坚定"融贯东西、鼎新致远"的奋斗信念 Havingstrong belief of "Integrate east and west, innovate for the long-term development"			
重点: Key Points	典型的递归结构，分治算法思想，Strassen 矩阵乘法，棋盘覆盖，线性时间选择，最接近点对问题 The construction of a typical Recursion, The Basic Idea of Divide-and-Conquer，matrix multiplication of Strassen，Chessboard Cover，Linear time selection，Closest Pair of Points Problem			
难点: Focal points	线性时间选择，最接近点对问题 Linear time selection，Closest Pair of Points Problem			

知识单元序号: Knowledge Unit No.	3		支撑教学目标: SLOs Supported	PA1-1,PA1-2,EQ2-1
知识单元名称 Unit Title	动态规划 Dynamic Programming			
知识点: Knowledge Delivery	矩阵连乘问题　Matrix-Chain Multiplication 动态规划算法的基本要素 The Basic Elements of Dynamic Programming 最长公共子序列　Longest Common Subsequence			
	最大子段和　Maximal Sub-segment Sum 凸多边形最优三角剖分 The Optimal Triangulation of Convex Polygon			
	图像压缩　Image Compression 流水作业调度 line Production Scheduling			
	0-1 背包问题 0-1 Knapsack Problem 最优二叉搜索树　Optimal Binary Search Tree			
学习目标: Learning Objectives	了解: Recognize	动态规划的基本思想 The Basic Idea of Dynamic Programming		
	理解: Understand	动态规划算法的基本要素 The Basic Elements of Dynamic Programming 最大子段和　Maximal sub-segment sum 流水作业调度 line Production Scheduling 最优二叉搜索树　Optimal Binary Search Tree		
	掌握: Master	矩阵连乘问题　Matrix-Chain Multiplication 最长公共子序列　Longest Common Subsequence 凸多边形最优三角剖分　The OptimalTriangulation of Convex Polygon 图像压缩　Image Compression 0-1 背包问题 0-1 Knapsack Problem		
德育目标 Moral Objectives	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 Having correct values and sense of social responsibility, good professional ethics and conduct			
重点: Key Points	动态规划算法的基本要素 The Basic Elements of Dynamic Programming 矩阵连乘问题　Matrix-Chain Multiplication 最长公共子序列　Longest common subsequence 凸多边形最优三角剖分 The optimal triangulation of Convex polygon 图像压缩　Image compression 0-1 背包问题 0-1 Knapsack problem			
难点: Focal points	最长公共子序列　Longest common subsequence 凸多边形最优三角剖分 The optimal triangulation of Convex polygon			

知识单元序号: Knowledge Unit No.	4		支撑教学目标: SLOs Supported	PA1-1,PA1-2,EQ2-1
知识单元名称 Unit Title	贪心算法 Greedy algorithm			
知识点: Knowledge Delivery	活动安排问题 Activity Arrangements Problem 贪心算法的基本要素 The Basic Elements of Greedy Algorithm 最优装载 The Optimal Loading 哈夫曼编码 Huffman Coding			
	单源最短路径 Single-Source Shortest Paths 最小生成树 Minimum Spanning Tree 多机调度问题 Multi-machine Scheduling Problem			
学习目标: Learning Objectives	了解: Recognize	贪心算法的基本思想 The Basic Idea of Greedy Algorithm		
	理解: Understand	贪心算法的基本要素 The Basic Elements of Greedy Algorithm 活动安排问题 Activity Arrangements Problem 哈夫曼编码 Huffman Coding		
	掌握: Master	最优装载 The Optimal Loading 单源最短路径 Single-Source Shortest Paths 最小生成树 Minimum Spanning Tree 多机调度问题 Multi-Machine Scheduling Problem		
德育目标 Moral Objectives	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 Having correct values and sense of social responsibility, good professional ethics and conduct			
重点: Key Points	贪心算法的基本要素 The Basic Elements of Greedy Algorithm 活动安排问题 Activity arrangements Problem 最优装载 The Optimal Loading 单源最短路径 Single-Source Shortest Paths 多机调度问题 Multi-Machine Scheduling Problem			
难点: Focal points	最优装载 The Optimal Loading 多机调度问题 Multi-Machine Scheduling Problem			

知识单元序号: Knowledge Unit No.	5		支撑教学目标: SLOs Supported	PA1-1,PA1-2,EQ2-2
知识单元名称 Unit Title	回溯法 Backtracking Algorithm			
知识点: Knowledge Delivery	回溯法的算法框架 The Algorithm Framework of Backtracking 装载问题 Loading Problem 批处理作业调度 Batch job scheduling			
	符号三角形问题 Signed Triangle Problem n 后问题 N Queens Problem 0-1 背包问题 0-1 Knapsack Problem			
	图的 m 着色问题 The M-coloring Problem of graphs 旅行售货员问题 Traveling salesman Problem			
	圆排列问题　Circle Permutation Problem 连续邮资问题 Continuous Postage Problem 回溯法的效率分析 The Efficiency Analysis of Backtracking Method			
学习目标: Learning Objectives	了解: Recognize	回溯法的基本思想 The Basic Idea of Backtracking Algorithm		
	理解: Understand	回溯法的算法框架 The Algorithm Framework of Backtracking 圆排列问题 Circle Permutation Problem 连续邮资问题 Continuous Postage Problem 回溯法的效率分析 The Efficiency Analysis of Backtracking Method		
	掌握: Master	装载问题 Loading Problem 批处理作业调度 Batch job Scheduling 符号三角形问题 Signed triangle Problem n 后问题 N queens Problem 0-1 背包问题 0-1 Knapsack Problem 图的 m 着色问题 The M-coloring Problem of Graphs 旅行售货员问题 Traveling Salesman Problem		
德育目标 Moral Objectives	具有优异的创新精神和终身学习能力，学习与运用新技术的能力突出，能够适应持续的环境变化与技术变革 Having innovation spirit and ability of lifelong learning, learning and applying new technologies, and be able to adapt to continuous environmental changes and technological changes			
重点: Key Points	回溯法的算法框架 The Algorithm Framework of Backtracking 装载问题 Loading Problem 批处理作业调度 Batch Job Scheduling 符号三角形问题 Signed Triangle Problem n 后问题 N Queens Problem　0-1 背包问题 0-1 Knapsack Problem 图的 m 着色问题 The M-coloring Problem of Graphs 旅行售货员问题 Traveling Salesman Problem			
难点: Focal points	符号三角形问题　Signed Triangle Problem n 后问题 N Queens Problem 旅行售货员问题 Traveling Salesman Problem			

知识单元序号: Knowledge Unit No.	6		支撑教学目标: SLOs Supported	PA1-1,PA1-2, PA1-3, EQ2-3
知识单元名称 Unit Title	分支限界法 Branch and Bound Method			
知识点: Knowledge Delivery	分支限界法的基本思想 The Basic Idea of Branch and Bound Method 单源最短路径问题 Single-source Shortest Paths 装载问题 Loading Problem			
	0-1 背包问题 0-1 Knapsack Problem 最大团问题 Maximum Clique Problem			
	旅行售货员问题 Traveling Salesman Problem 批处理作业调度 Batch job Scheduling			
学习目标: Learning Objectives	了解: Recognize	分支限界法的基本思想 The Basic Idea of Branch and Bound Method		
	理解: Understand	单源最短路径问题 Single-source Shortest Paths 最大团问题 Maximum Clique Problem		
	掌握: Master	装载问题 Loading Problem 0-1 背包问题 0-1 Knapsack Problem 旅行售货员问题 Traveling Salesman Problem 批处理作业调度 Batch Job Scheduling		
德育目标 Moral Objectives	胸怀"自强不息、知行合一"的东大品格 NEU character of "Striving constantly for improvement and behaving in conformity with truth"			
重点: Key Points	单源最短路径问题 Single-source Shortest Paths 装载问题 Loading Problem 0-1 背包问题 0-1 Knapsack Problem 旅行售货员问题 Traveling Salesman Problem 批处理作业调度 Batch Job Scheduling			
难点: Focal points	装载问题 Loading Problem 旅行售货员问题 Traveling Salesman Problem			

知识单元序号: Knowledge Unit No.	7		支撑教学目标: SLOs Supported	PA1-1,PA1-2, PA1-3, EQ2-5
知识单元名称 Unit Title	随机化算法 Randomized Algorithm			
知识点: Knowledge Delivery	随机数 Random Number 数值随机化算法 Numerical Randomization Algorithm 舍伍德算法 Sherwood Algorithm			
	拉斯维加斯算法　Las Vegas Algorithm 蒙特卡罗算法 Monte-carlo Method			
学习目标: Learning Objectives	了解: Recognize	随机数　Random Number		
	理解: Understand	数值随机化算法 Numerical Randomization Algorithm		
	掌握: Master	舍伍德算法 Sherwood Algorithm 拉斯维加斯算法　Las Vegas Algorithm 蒙特卡罗算法 Monte-carlo Method		
德育目标 Moral Objectives	具有良好的跨文化、跨领域沟通交流能力 Good cross-cultural and cross-field communication skills			
重点: Key Points	数值随机化算法 Numerical Randomization Algorithm 舍伍德算法 Sherwood Algorithm 拉斯维加斯算法　Las Vegas Algorithm 蒙特卡罗算法 Monte-carlo Method			
难点: Focal points	拉斯维加斯算法　Las Vegas Algorithm 蒙特卡罗算法 Monte-carlo Method			

四、教学安排 TeachingSchedule

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.
计算机算法概述 Introduction to Computer Algorithm	4
递归与分治策略 Recursion and Divide-and-Conquer Strategies	6
动态规划 Dynamic Programming	8
贪心算法 Greedy algorithm	4
回溯法 Backtracking Algorithm	8
分支限界法 branch and bound method	6
随机化算法 randomized algorithm	4
总计 Total	40

注：可根据实际情况增减行数

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 linesor 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-basedlecturing
☑	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 Knowledgedeliverywiththiceducation
☑	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 linesor revise content based on subject.

考核环节: Assessment Content	其他 Others	环节负责人: Director	宋欣
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	20
考核方式: Measures	平时知识点测试，回答问题，作业完成情况等 Knowledge test at ordinary times, Answer the questions, Job completion and so on.		

考核环节: Assessment Content	理论 LECT	环节负责人: Director	宋欣
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	80
考核方式: Measures	期末综合理论知识结课论文 The final thesis of the comprehensive theoretical knowledge		

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.

<table>
<tr><td colspan="4" align="center">教学大纲改进机制 Subject Syllabus Improvement Mechanism</td></tr>
<tr><td align="center">考核周期(年):
Check Period（YR）</td><td align="center">4</td><td align="center">修订周期(年):
Revise Period (YR)</td><td align="center">4</td></tr>
<tr><td align="center">改进措施:
Measures</td><td colspan="3">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 improvement.</td></tr>
<tr><td colspan="4" align="center">成绩评定改进机制 Assessment Improvement Mechanism</td></tr>
<tr><td align="center">考核周期(年):
Check Period（YR）</td><td align="center">1</td><td align="center">修订周期(年):
Revise Period (YR)</td><td align="center">1</td></tr>
<tr><td align="center">改进措施:
Measures</td><td colspan="3">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.</td></tr>
</table>