

数据结构 教学大纲

Data Structures Subject Syllabus

一、课程信息 Subject Information

课程编号: Subject ID	3100212005	开课学期: Semester	3
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	4.5	总学时/周: Total Hours/Weeks	72
理论学时: LECT. Hours	56	实验学时: EXP. Hours	16
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	必修 Compulsory	课程模式: Mode	互认 EQV
中方课程协调人: NEU Coordinator	沈哲 Shen Zhe	成绩记载方式: Result Type	百分制 Marks
先修课程: Requisites	C++程序设计基础 Fundamentals of C++ Programming		
英文参考教材: EN Textbooks	Mark Allen Weiss., Data Structures and Algorithm Analysis in C, Second Edition, 机械工业出版社, 2010		
中文参考教材: CN Textbooks	严蔚敏, 吴伟民 编著, 数据结构 (C 语言版), 清华大学出版社, 2018		
教学资源: Resources	http://www.cppreference.com/ http://www.cplusplus.com/		
课程负责人(撰写人): Subject Director	沈哲 Shen Zhe	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	沈哲 Shen Zhe		
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.

<p>整体目标: Overall Objective</p>	<p>使用计算机来解决实际问题时，涉及到数据的表示及数据的处理，而数据表示及数据处理正是数据结构课程的主要研究对象，通过这两方面内容的学习，为后续课程打下坚实的知识基础，同时也提供了必要的技能训练。</p> <p>为此，本课程通过课堂教学和上机实习，使学生了解数据组织的基本方法，具备分析和解决现实问题在计算机中如何表示和处理的能力并培养良好的程序设计技能，以便为数据选择适当的逻辑、存储结构及相应算法，了解对算法的时间和空间分析方法。</p> <p>本课程在基础方面，要求学生掌握常用数据结构的基本概念及其不同的实现方法；在技能方面，通过系统学习能够在不同存储结构上实现不同的运算，并掌握算法设计的方式和技巧。</p> <p>When using computer to solve practical problems, it involves data representation and data processing. Data representation and data processing are the main research objects of data structure course. Through the study of these two aspects, it lays a solid knowledge foundation for the follow-up courses and provides necessary skills training.</p> <p>Therefore, through classroom teaching and computer practice, students can understand the basic methods of data organization, have the ability to analyze and solve practical problems in the computer and cultivate good programming skills, so as to select the appropriate logic, storage structure and corresponding algorithms for data, and understand the time and space analysis methods of the algorithm.</p> <p>In the basic aspect, students are required to master the basic concepts of common data structure and their different implementation methods; In terms of skills, different operations can be realized in different storage structures through system learning, and the design methods and skills of the algorithm can be mastered.</p>	
<p>(1) 专业目标: Professional Ability</p>	<p>1-1</p>	<p>理解常用的算法度量方法，包括时间复杂度和空间复杂度。 Understand common algorithm metrics, including time complexity and space complexity.</p>
	<p>1-2</p>	<p>理解抽象数据类型的定义和功能作用。 Understand the definition and function of abstract data types.</p>
	<p>1-3</p>	<p>掌握常用数据结构的定义、操作及实现，包括线性表、栈、队列、树、图等。 Master the definition, operation and implementation of common data structure, including linear list, stack, queue, tree, graph, etc.</p>
	<p>1-4</p>	<p>掌握常用排序方法，能够根据需求实现合理的排序方式。 Master the common sorting methods, and be able to achieve a reasonable sorting method according to the needs.</p>

(2) 德育目标: Essential Quality	2-1	明确掌握数据结构与算法对计算机程序设计的重要意义及发展趋势。 The significance and development trend of mastering data structure and algorithm for computer program design are clear.
	2-2	数据结构与算法强调逻辑分析与实践相结合，理论联系实际，保证基础软件安全稳定，实现知行合一。 Data structure and algorithm emphasize the combination of logical analysis and practice, theory with practice, ensure the security and stability of basic software, realize the unity of knowledge and practice.
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、工程知识：能够将数学、自然科学、工程基础和专业知识用于解决复杂工程问题。 GA1. Engineering Knowledge: Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	指标点 1-2：掌握程序设计、数据结构、算法分析与设计、计算机数字系统、操作系统等专业知识，具备计算机程序设计开发能力和计算机与信息系统设计开发与维护能力； 1-2: Mastery of programming, data structure, algorithms analysis and design, computer digital system, and operating system, etc., and capable of computer programming and design, design and maintenance of computer and information systems;	1-1, 1-2, 1-3, 1-4, 2-2
3、设计/开发解决方案：能够设计针对复杂工程问题的解决方案，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。 Design/Development of Solutions: Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, and safety, cultural, societal and environmental considerations.	指标点 3-1：能够设计针对本专业相关复杂工程问题的解决方案，能够设计和开发实现特定功能、满足特定需求的计算机、软件或网络系统。 3-1: Capable of designing solutions to complex engineering problems related to the major, and capable of designing and developing computers, software or network systems that can function specifically and meet specific requirements.	1-3, 1-4
	指标点 3-3：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。 3-3: Capable of taking social, health, safety, legal, cultural and environmental factors in consideration during all aspects of design and development.	2-2

<p>4、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。</p> <p>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.</p>	<p>指标点 4-3：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。</p> <p>Capable of tracking the international cutting-edge technology trends, master the important technical indicators involved in the major and the technical approaches needed to achieve the indicators.</p>	<p>2-1, 2-2</p>
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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, 2-1, 2-2
知识单元名称 Unit Title	数据结构与算法简介 Introduction of data structure and algorithm.		
知识点: Knowledge Delivery	数据结构的概念 The concept of data structure.		
	数据结构的历史与发展 The history and development of data structure.		
	算法的概念 The concept of algorithm.		
	算法的度量 Measurement of algorithm.		
学习目标: Learning Objectives	了解: Recognize	数据结构与算法的发展 The history and development of data structure and algorithm.	
	理解: Understand	数据结构与算法的概念 The concept of data structure and algorithm.	
	掌握: Master	算法的度量方法，包括时间复杂度和空间复杂度 The measurement method of the algorithm, includes time complexity and space complexity.	
德育目标 Moral Objectives	2-1, 2-2		
重点: Key Points	数据结构与算法的概念 The concept of data structure and algorithm.		

难点: Focal points	算法的度量方法, 包括时间复杂度和空间复杂度 The measurement method of the algorithm, includes time complexity and space complexity.
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知识单元序号: Knowledge Unit No.	2	支撑教学目标: SLOs Supported	1-2, 1-4
知识单元名称 Unit Title	线性表 Linear List		
知识点: Knowledge Delivery	线性表的定义 The definition of linear list.		
	线性表的应用 The application of linear list.		
	线性表的抽象数据类型 Abstract data type of linear list.		
	线性表的概念与逻辑结构和存储结构 The concept, logical structure and storage structure of linear list.		
学习目标: Learning Objectives	了解: Recognize	线性表的概念 The concept of linear list.	
	理解: Understand	线性表的抽象数据类型 The abstract data type of linear list.	
	掌握: Master	线性表的逻辑结构和存储结构 The logical structure and storage structure of linear list.	
德育目标 Moral Objectives	2-1, 2-2		
重点: Key Points	线性表的抽象数据类型 The abstract data type of linear list.		
难点: Focal points	线性表的逻辑结构和存储结构 The logical structure and storage structure of linear list.		

知识单元序号: Knowledge Unit No.	3	支撑教学目标: SLOs Supported	1-2, 1-3, 1-4
知识单元名称 Unit Title	栈与队列 Queue and Stack		
知识点: Knowledge Delivery	栈与队列的定义 The definition of queue and stack.		
	栈与队列的特征 The characteristics of queue and stack.		
	栈与队列的抽象数据类型 The abstract data type of queue and stack.		
	栈与队列的逻辑结构与存储结构 The logical structure and storage structure of queue and stack.		
学习目标: Learning Objectives	了解: Recognize	栈与队列的定义 The definition of queue and stack.	
	理解: Understand	栈与队列的特征 The characteristics of queue and stack.	
	掌握: Master	栈与队列的逻辑结构与存储结构 The logical structure and storage structure of queue and stack.	
德育目标 Moral Objectives	2-1, 2-2		

重点: Key Points	栈与队列的逻辑结构与存储结构 The logical structure and storage structure of queue and stack.
难点: Focal points	栈与队列的特征 The characteristics of queue and stack.

知识单元序号: Knowledge Unit No.	4	支撑教学目标: SLOs Supported	1-2, 1-3, 1-4
知识单元名称 Unit Title	树 Tree		
知识点: Knowledge Delivery	树的定义 The definition of tree.		
	树的特征 The characteristics of tree.		
	树的抽象数据类型 The abstract data type of tree.		
	树的逻辑结构与存储结构 The logical structure and storage structure of tree.		
学习目标: Learning Objectives	了解: Recognize	树的定义 The definition of tree.	
	理解: Understand	树的特征 The characteristics of tree.	
	掌握: Master	树的逻辑结构与存储结构 The logical structure and storage structure of tree.	
德育目标 Moral Objectives	2-1, 2-2		
重点: Key Points	树的逻辑结构与存储结构 The logical structure and storage structure of tree.		
难点: Focal points	树的特征 The characteristics of tree.		

知识单元序号: Knowledge Unit No.	5	支撑教学目标: SLOs Supported	1-2, 1-3, 1-4
知识单元名称 Unit Title	图 Graph		
知识点: Knowledge Delivery	图的定义 The definition of graph.		
	图的特征 The characteristics of graph.		
	图的抽象数据类型 The abstract data type of graph.		
	图的逻辑结构与存储结构 The logical structure and storage structure of graph.		
学习目标: Learning Objectives	了解: Recognize	图的定义 The definition of graph.	
	理解: Understand	图的特征 The characteristics of graph.	
	掌握: Master	图的逻辑结构与存储结构 The logical structure and storage structure of graph.	
德育目标 Moral Objectives	2-1, 2-2		

重点: Key Points	图的逻辑结构与存储结构 The logical structure and storage structure of graph.
难点: Focal points	图的特征 The characteristics of graph.

知识单元序号: Knowledge Unit No.	6	支撑教学目标: SLOs Supported	1-2, 1-3, 1-4
知识单元名称 Unit Title	排序 Sorting		
知识点: Knowledge Delivery	排序的定义 The definition of srotng.		
	排序的应用 The application of sorting.		
	常用排序算法 Common sorting algorithm.		
	常用排序算法时间复杂度 Time complexity of common sorting algorithms.		
学习目标: Learning Objectives	了解: Recognize	排序的定义 The definition of srotng.	
	理解: Understand	常用排序算法时间复杂度 Time complexity of common sorting algorithms.	
	掌握: Master	常用排序算法 Common sorting algorithm.	
德育目标 Moral Objectives	2-1, 2-2		
重点: Key Points	常用排序算法 Common sorting algorithm.		
难点: Focal points	常用排序算法时间复杂度 Time complexity of common sorting algorithms.		

(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	线性表的应用 Application of linear list	2	1	设计性 Design	必做 Elec
2	栈的应用 Application of stack	2	1	设计性 Design	必做 Elec
3	队列的应用 Application of queue	2	1	设计性 Design	必做 Elec
4	树的应用 Application of tree	3	1	设计性 Design	必做 Elec
5	图的应用	3	1	设计性	必做

	Application of graph			Design	Elec
6	排序算法 Sorting	4	1	综合性 Comp	必做 Elec
	总计 Total	16			

*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	李佳音 Li Jiayin
实验名称: Experiment Title	线性表的应用 Application of linear list		
实验内容: Content	线性表的插入与删除 Insert and delete element in linear list.		
学习目标: Learning Objectives	熟悉线性表的基本操作 Master the basic operation of linear list.		
教学要求: Requirements	能够实现线性表的创建、销毁、插入、删除等常用操作。 Realize the creation, destroy, insertion, deletion and other common operations of linear table.		
实验场地: Location	综合楼 1209, Zonghe Building 1209		
实验软硬件设备: Software/Hardware	台式计算机 Personal 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	李佳音 Li Jiayin
实验名称: Experiment Title	栈的应用 Application of stack		
实验内容: Content	栈的出栈与入栈 Push and pop in stack.		
学习目标: Learning Objectives	熟悉栈的基本操作 Master the basic operation of stack.		
教学要求: Requirements	能够实现栈的创建、销毁、出栈、入栈等常用操作。 Realize the creation, destroy, push, pop and other common operations of stack.		

实验场地: Location	综合楼 1209, Zonghe Building 1209
实验软硬件设备: Software/Hardware	台式计算机 Personal Computer

实验项目序号: Experiment No.	3	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	李佳音 Li Jiayin
实验名称: Experiment Title	队列的应用 Application of queue		
实验内容: Content	元素的入队与出队操作 A element join in and leave from queue.		
学习目标: Learning Objectives	熟悉队列的基本操作 Master the basic operation of queue.		
教学要求: Requirements	能够实现队列的创建、销毁、出队、入队等常用操作。 Realize the creation, destroy, join, leave and other common operations of queue.		
实验场地: Location	综合楼 1209, Zonghe Building 1209		
实验软硬件设备: Software/Hardware	台式计算机 Personal Computer		

实验项目序号: Experiment No.	4	支撑教学目标: SLOs Supported	1-2, 1-3, 1-4
每组成员: Members per Group	1	指导教师: Tutor	李佳音 Li Jiayin
实验名称: Experiment Title	树的应用 Application of tree		
实验内容: Content	树的遍历 Traverse of tree.		
学习目标: Learning Objectives	熟悉树的基本操作 Master the basic operation of tree.		
教学要求: Requirements	能够实现树的创建、销毁、插入、删除、遍历等常用操作。 Realize the creation, destruction, insert, delete, traverse and other common operations of tree.		
实验场地: Location	综合楼 1209, Zonghe Building 1209		

实验软硬件设备: Software/Hardware	台式计算机 Personal Computer		
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实验项目序号: Experiment No.	5	支撑教学目标: SLOs Supported	1-2, 1-3, 1-4
每组成员: Members per Group	1	指导教师: Tutor	李佳音 Li Jiayin
实验名称: Experiment Title	图的应用 Application of graph		
实验内容: Content	图的插入删除与遍历 Element insert delete and traverse in graph.		
学习目标: Learning Objectives	熟悉图的基本操作 Master the basic operation of graph.		
教学要求: Requirements	能够实现图的存储、插入、删除、遍历等常用操作。 Realize the storage, insertion, deletion, traverse and other common operations of graph.		
实验场地: Location	综合楼 1209, Zonghe Building 1209		
实验软硬件设备: Software/Hardware	台式计算机 Personal Computer		

实验项目序号: Experiment No.	6	支撑教学目标: SLOs Supported	1-2, 1-3, 1-4
每组成员: Members per Group	1	指导教师: Tutor	李佳音 Li Jiayin
实验名称: Experiment Title	排序 Sorting		
实验内容: Content	冒泡排序与归并排序 Bubble sort and merge sort.		
学习目标: Learning Objectives	掌握常用的排序方法 Master the common sorting methods.		
教学要求: Requirements	能够实现规定时间复杂度的排序算法。 A sorting algorithm with specified time complexity can be realized.		
实验场地: Location	综合楼 1209, Zonghe Building 1209		
实验软硬件设备: Software/Hardware	台式计算机 Personal 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.
数据结构与算法简介 Introduction of data structure and algorithm	2			
算法度量 Measurement of algorithm	2			
线性表 Linear list	8	2		
栈 Stack	6	2		
队列 Queue	6	2		
树 Tree	10	3		
图 Graph	10	3		
排序 Sorting	12	4		
总计 Total	56	16		

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
<input checked="" type="checkbox"/>	多媒体教学：基于信息化设备的课堂教学 Multi-media-based lecturing
<input checked="" type="checkbox"/>	实践能力传授：理论与行业、实际案例相结合 Combining theory with industrial practical problems
<input checked="" type="checkbox"/>	课程思政建设：知识讲授与德育相结合 Knowledge delivery with ethic education
<input checked="" type="checkbox"/>	PBL 教学：问题驱动的分组学习与交流 Problem-based learning
<input type="checkbox"/>	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	沈哲 Shen Zhe
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	10
考核方式: Measures	<p>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。</p> <p>The full score is 100 points. Students' usual classroom performance is recorded by learning pass. Each attendance is 10 points. No score is given if they are absent from work. If they are absent for five times or more, they will be disqualified.</p>		

考核环节: Assessment Content	实验 Experiment	环节负责人: Director	李佳音 Li Jiayin
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	20
考核方式: Measures	<p>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。</p> <p>The full score is 100. If you fail in the experiment (below 60), you are not allowed to take the final examination. Students' performance was recorded through classroom performance and experimental report. Each attendance was scored 10 points, and absence was not scored.</p>		

考核环节: Assessment Content	期中 Mid-term	环节负责人: Director	沈哲 Shen Zhe
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	20
考核方式: Measures	<p>满分 100 分，包含 5 次作业，每次 20 分。</p> <p>The full score is 100, including 5 assignments, 20 points each time.</p>		

考核环节: Assessment Content	期末 Final	环节负责人: Director	沈哲 Shen Zhe
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 students' scores are given by marking the final examination papers.
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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.		