课程详述
COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	算法设计与分析　Algorithm Design and Analysis
2.	授课院系 Originating Department	计算机科学与工程系 Department of Computer Science and Technology
3.	课程编号 Course Code	CS208
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业基础课　Major Foundational Courses
6.	授课学期 Semester	春季　Spring
7.	授课语言 Teaching Language	英文　English
8.	授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师） Instructor(s), Affiliation& Contact （For team teaching, please list all instructors）	史玉回，讲席教授，计算机科学与工程系，shiyh@sustech.edu.cn Yuhui Shi, Chair Professor, Department of Computer Science and Engineering, shiyh@sustech.edu.cn
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	赵耀，教学实验员，计算机科学与工程系，zhaoy6@sustech.edu.cn Yao Zhao, Teaching laboratory technician, Department of Computer Science and Engineering, zhaoy6@sustech.edu.cn
10.	选课人数限额(可不填) Maximum Enrolment （Optional）	

11.	授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other（Please specify）	总学时 Total
	学时数 Credit Hours	32		32		64

12.	先修课程、其它学习要求 **Pre-requisites or Other Academic Requirements**	CS102A 计算机程序设计基础 A Introduction to Computer Programming A CS203 数据结构与算法分析 Data Structures and Algorithm Analysis
13.	后续课程、其它学习规划 **Courses for which this course is a pre-requisite**	None
14.	其它要求修读本课程的学系 **Cross-listing Dept.**	Not applicable for other departments beside CS

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教学大纲及教学日历 SYLLABUS

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15.   教学目标 **Course Objectives**

The course aims to teach students the basic concepts on algorithms, and introduce the fundamentals of algorithm design and analysis techniques. In this course, the students will be familiar with major algorithms, such as fundamental graph-based algorithms, greedy algorithms, divide-and-conquer algorithms, dynamic programming algorithms, and network flow algorithms. In addition, upon completion of this course, the students should be able to program these algorithms for solving corresponding problems.

16.   预达学习成果 **Learning Outcomes**

Upon completion of this course, students shall have the capabilities of doing:

1) Prove the correctness of algorithms;

2) Analyze the asymptotic order of growth of algorithms;

3) Be familiar with major algorithms like fundamental graph-based algorithms, greedy algorithms, divide-and-conquer algorithms, dynamic programming algorithms, and network flow algorithms;

4) Apply design and analysis methods to the above-mentioned major algorithms;

5) Implement these major algorithms by using a programming language.

17.   课程内容及教学日历 （如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）
   Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

Week 1: Introduction to Algorithm Design and Analysis

Stable Matching Problem

[Lab 1] Reviewing the Stable Matching algorithm and construction skills of test cases

Week 2: Five Representative Problems

Interval Scheduling

Weighted Interval Scheduling

Bipartite Matching

Independent Set

Competitive Facility Location

[Lab 2] Programming stable matching algorithms

Week 3: Basics of Algorithm Analysis

Computational Tractability

Asymptotic Order of Growth

Common Running Time

[Lab 3] Writing a runtime survey program, and testing the algorithms with n, nlogn, n^2 and other time complexity. Observing that how the runtime changes with the increase of the input scale of the problem.

Week 4 &5: Graphs

Graph Traversal

Testing Bipartiteness

Connectivity in Directed Graphs

DAG and Topological Ordering

[Lab 4] Using BFS or DFS to solve some Graph Search Problems

[Lab 5] Using Topological Ordering to solve some common problems, such as courses scheduling or projects planning

Week 6, 7 & 8: Greedy Algorithms

Interval Scheduling

Interval Partitioning

Scheduling to Minimize Lateness

Optimal Caching

Shortest Paths in a Graph

Minimum Spanning Tree

Clustering

Huffman Codes

[Lab 6] Solving some Interval Scheduling problems

[Lab 7] Using MST to solve some problems

[Lab 8] Using Huffman to solve some problems

Week 9 & 10: Divide and Conquer

Mergesort

Counting Inversions

Closest Pair of Points

Integer Multiplication

Convolution and FFT

[Lab 9] Implementing a simple application of Divide and Conquer

[Lab 10] Implementing a comprehensive application of Divide and Conquer

Week 11, 12 & 13: Dynamic Programming

Weighted Interval Scheduling

Segmented Least Squares

Knapsack Problem

RNA Secondary Structure

Sequence Alignment

Shortest Paths

[Lab 11] Solving a simple dynamic programming problem

[Lab 12] Solving the simple knapsack problem

[Lab 13] Ssolving the comprehensive knapsack problem

Week 14, 15 : Network Flow

Minimum Cut Problem

Maximum Flow Problem

Ford-Fulkerson Algorithm

Good Augmenting Paths

[Lab 14] Explaning Network Flow algorithms and Application Examples

[Lab 15] Solving the comprehensive network problem

Week 16: Review and Preparation for Final Exams

[Lab 16] Review, Q&A

18. 教材及其它参考资料 **Textbook and Supplementary Readings**

Jon Kleinberg and Eva Tardos, Algorithm Design, Pearson

课程评估 ASSESSMENT

19.	评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
	出勤 Attendance	5 min/per time	10%		
	课堂表现 Class Performance				
	小测验 Quiz				
	课程项目 Projects				
	平时作业 Assignments	2 hours/per time	20%		
	期中考试 Mid-Term Test				
	期末考试 Final Exam	2 hours	40%		
	期末报告 Final Presentation				
	其它（可根据需要改写以上评估方式） Others (The above may be modified as necessary)	2 hours per week	30%		Lab

20.　　　　记分方式 GRADING SYSTEM

> ☑ A. 十三级等级制 Letter Grading
> ☐ B. 二级记分制（通过/不通过）Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21.　　　本课程设置已经过以下责任人/委员会审议通过
　　　　　This Course has been approved by the following person or committee of authority