交叉信息研究院

20470012 Java程序设计基础　　　2学分　　32学时
Java Programming

介绍 Java 程序设计的基础语法，面向对象程序设计方法，Java 集合，泛型，异常处理，多线程，IO 接口，图形用户界面，数据的存储与访问，Severlet 等。

30470013 计算机入门　　　　　　3学分　　48学时
General Computer Science

Designed to appeal to a diverse audience, this course examines some of the fundamental ideas of the science of computing. Lectures and hands-on assignments cover a wide variety of topics such as hardware organization, the Internet, computer programming, limits of computing, and graphics. No prerequisite.

30470023 计算机应用数学　　　　3学分　　48学时
Mathematics for Computer Science

This course aims to introduce the fundamental mathematical techniques useful for computer science undergraduate majors, illustrated with a rich spectrum of applications. Modern computer science education requires the students to be equipped with broad knowledge in mathematics, so that they could cope with current and future technological challenges handily and innovatively. In this course, mathematical techniques from algebra, geometry, probability theory, stochastic modeling, and information theory will be covered. These techniques will be applied to algorithmic and design problems in various topics, including internet, cryptography, distributed systems, wireless sensor network, optimization, etc. Finally, this course introduces the students to deep scientific issues in the foundation of computing such as undecidability, complexity, and quantum computers.

30470034 程序设计与算法基础　　4学分　　64学时
Foundations of Programming and Algorithms

This course assumes that the students have the basic knowledge of programming languages, e.g. functions, loops, and arrays, etc. Topics to be covered include an overview of fundamental programming concepts in C/C++ (e.g. procedural programming and object-oriented programming), data structures (e.g. linked lists, stacks, queues, and trees), common algorithms that related to those data structures, and an introduction of programming patterns (e.g. reference count, virtual constructor).

30470093 计算生物学　　　　　　3学分　　48学时
Computational Biology

To introduce various computational problems for analyzing biological data (e.g. DNA, RNA, protein sequences, and biological networks) and the algorithms for solving these problems. Topics covered include: biological sequence analysis, gene identification, regulatory motif discovery, genome assembly, genome duplication and rearrangements, evolutionary theory, clustering algorithms, and scale-free networks.

30470104 机器学习　　　　　　　4学分　　64学时
Machine learning

Machine learning studies how computers can learn from experiences. Combining ideas from theoretical computer science and statistics, researchers have developed many learning methods and their applications to computer vision, bioinformatics, natural language processing etc. are highly successful. Machine learning theory addresses the fundamental problems in learning. It studies the power and theoretical limits of learning. The aim is to provide deep understand of learning and the guidance for the development of practical algorithms.

30470113 高等计算机图形学　　　3学分　　48学时
Advanced Computer Graphics

本课程是为清华大学计算机系本科生开设的选修课，旨在介绍计算机图形学的基本概念、理论、方法和系统，主要内容包括：颜色模型、光照模型、明暗处理、纹理、光线跟踪算法、曲线曲面造型和几何处理等。

30470124 算法设计   4学分   64学时

Algorithm Design

This course gives an introduction to the basics of algorithm, common algorithm design techniques, and the analysis of running time (complexity). The main contents include: tools of algorithm analysis, divide and conquer algorithms, dynamic programming, greedy algorithms etc. algorithm design techniques, and NP complete, randomized algorithms, approximation algorithms and other advanced topics.。

30470134 计算理论   4学分   64学时

Theory of Computation

This course gives an introduction to the basics of computation theory, including: Finite Automata, Regular language, Pushdown Automata, Context-Free Grammars, Turing machine, undecidablity, and computational intractable topics (NP complete, PSPACE, BPP etc).

30470143 理论计算机科学数学技巧 3学分   48学时

Fundamental Ideas in Theoretical Computer Science

"This course aims to introduce students to fundamental mathematical techniques required to pursue computer science (and theoretical computer science in particular) at a research level. However, the course is not only focused on mathematical techniques and CS theory: examples will from a rich array of applications in different fields of computer science. The mathematical material may include (but is not limited to) algebra, high-dimensional geometry, LP and SDP (semidefinite programming), information theoretic methods, stochastic processes, fourier analysis and boolean function analysis, discrete fourier transform and fast fourier transform, coding theory and expanders. Other topics may include Barrington's theorem, Newman's theorem, the INW pseudorandom generator and the Nisan-Widgerson PRG. This will be a fast-paced course.

30470154 博弈论   4学分   64学时

Game Theory

It is preferable that students have studied basic linear algebra, and have basic calculus skills. Although this is not required because we will develop the mathematical skills as we introduce the material.This course will serve as an introduction to game theory. We will begin from the very basics of game theory. We will work on important concepts like Nash equilibria, and end with a taste of more advanced subjects like evolutionary game theory and games on graphs.

40470014 高等算法   4学分   64学时

Advanced Algorithms

The course is meant for an elite group of undergraduate (juniors) computer science students who are more mathematically oriented. They have had a first course in algorithms, and a first course in theory of computation. So this course is meant to be a 2nd course in Algorithms.。

40470024 密码学基础   4学分   64学时

Fundamentals of Cryptography

The purpose of this unit is to introduce the basic concepts of modern cryptography. We start this tour by a very brief introduction to classic cryptography, and main issues related to the distribution of digital content such as confidentiality, integrity and non-repudiation. After a short introduction to the preliminaries, we will show several equivalent cryptographic primitives and their reductions to each other. Privacy issues and solutions are discussed in the context of modern private-key and public-key cryptography. Next, we will review tools allowing authentication of digital content using hash function and digital signatures. The presented constructions are building blocks for designing secure systems and protocols for real-world applications. Attacks and security analysis of the cryptographic schemes and protocols will also be discussed.

40470034 分布式计算（基础与系统） 4学分 80学时

Distributed Computing (Fundamentals and Systems)

Through this course, students will learn fundamental algorithms and principles in distributed computing systems, such as logical clocks, consensus problem, failure detection, Byzantine agreement, distributed locking, and gossip protocols. They will also learn how to design and analyze distributed systems using these fundamental algorithms and principles through the study of a number of advance distributed systems.

40470042 当前计算机研究热门课题 2学分 32学时

Current Topics in Computer Science

This course provides an overview to the state of the art of computer science research. The goal is to introduce students to the frontier of computer science research and help them plan their career in the computer industry. The course will devote one or a few lectures to each field. Examples of topics include computer systems, computer networking, information security, computer graphics, computer vision, web search and mining, multimedia, speech technology, and natural language processing.

40470050 计算机科学研究实践 15学分

Computer Science Research Practice

本课程学生所参与的研究方向包括：计算机理论，计算机系统，无线和网络，计算机图形学，计算机视觉，语音识别，自然语言处理，搜索和数据挖掘，人机交互等。

40470085 专题训练实践 5学分

Research Immersion Training

本课程设在大三年级夏季学期，是为大四年级的《计算机科学研究实践》和《综合论文训练》做准备。在该课程中，设置了算法理论、量子网络、复杂性研究、密码及安全、博弈论等专题，并根据学生的兴趣安排进入各专题训练小组进行专题研讨和实践，使学生在实际动手能力、创新思维、团队合作精神等方面得到锻炼和提高。

40470094 量子信息 4学分 64学时

Quantum Information

Quantum Information is a course offered to upper level undergraduate students (junior or senior students in the Yao Class, physics, EE, and computer science departments) and graduate students. The course will cover many topics at the forefront of the new field of quantum information science, including, for instance, quantum entanglement theory, quantum cryptography, quantum communication theory, quantum computing models, quantum algorithms and complexity theory, quantum error correction and fault-tolerant computation, physical implementation of quantum computation, communication and networks.

40470104 网络科学 4学分 64学时

Network Science

Network science is a new and emerging scientific discipline that examines the interconnections among diverse physical or engineered networks, information networks, biological networks, cognitive and semantic networks, and social networks. In this course, we examine the many facets of internet from the algorithmic perspective, including for instance the mathematical modeling of large-scale networks, information retrieval algorithms for massive data sets, algorithmic game theory and electronic commerce. Specific topics include small world phenomena, power law distributions, rank aggregation, web crawling, hubs and authorities, clustering large data sets, streaming algorithms, network routing, Nash equilibrium, market clearing, mechanism design, auction theory, social networks, etc.

40470113 信息论与网络编码 3学分 48学时

Information Theory and Network Coding

This course is an introduction of the information theory developed by Claude Shannon and network coding.

Information theory is a branch of applied mathematics and electrical engineering involving the quantification of information. Network coding is one of the most active research frontiers in information theory。

40470142 计算机安全的理论及实践 2学分 32学时

Computer Security: Theory and Practice

这门课程将主要介绍包括保密性、完整性、可用性等性质在内的信息安全的各个方面，以及实现信息安全所对应的密码学手段。我们也将介绍一些现代对称密码学算法，以及它们在嵌入式系统中的实现，主要包括数据加密算法(DES)，高等加密算法(AES)等。最后会介绍针对嵌入式系统的数学方法和物理手段的攻击，以及相应的对策。

40470154 机器学习与模式识别 4学分 64学时

Machine Learning and Pattern Recognition

Machine learning is a scientific discipline concerned with the design and development of algorithms that allow computers to evolve behaviors like human being. It is the core of the artificial intelligence and is rapidly applied to various areas nowadays, such as search and social network. This course will introduce the fundamental of machine learning techniques and explain its implication in the machine translation. We aim to allow students to master key skills and to be able to develop novel algorithms in machine learning.