

# 概率与计算 课程教学大纲

## Course Outline

课程基本信息 (Course Information)					
课程代码 (Course Code)	CS225	*学时 (Credit Hours)	32	*学分 (Credits)	2
*课程名称 (Course Title)	(中文) 概率与计算				
	(英文) Probability and Computing				
*课程性质 (Course Type)	专业选修课				
授课对象 (Target Audience)	2016 级计算机科学与技术 (致远荣誉计划)				
*授课语言 (Language of Instruction)	中英文				
*开课院系 (School)	致远学院				
先修课程 (Prerequisite)					
授课教师 (Instructor)	李翼		课程网址 (Course Webpage)		
*课程简介 (Description)	<p>如今, 计算机科学的每一个方面都受到概率论的影响. 随机性在密码、数值模拟、通过采样计算统计量、机器学习、数据压缩、纠错码、数据结构、计算几何、大规模网络应用方面都有重要应用. 随机算法使用了随机数且随机数的具体值直接或者间接影响算法的执行流程或结果, 故并不保证其输出恒为正确, 而只保证输出以某目标概率正确. 虽然较传统确定性算法的输出弱一些, 随机算法在诸多问题上都较确定性算法简单, 故应用广泛. 本课程将着重于随机算法和算法的概率分析. 一些算法, 特别是与大数据相关的算法, 其算法分析的数学基础为处于当代概率论中心的测度集中现象, 简而言之, 是众多随机量表现出一种‘确定性’的结果, 就像众多原子的随机运动在宏观上表现出确定的物理定律. 本课程也将就测度集中现象及其应用做适当展开.</p>				
*课程简介 (Description)	<p>Today every aspect of the computer science has been influenced by probability theory. Randomization has seen broad and important applications in cryptography, numerical simulation, statistics via sampling, machine learning, data compression, error correction, data structure, computational geometry and the large-scale network. A randomized algorithm has access to random source and the instances of random numbers will directly or indirectly affect the execution or the output of the algorithm. It is therefore not guaranteed that a randomized algorithm always outputs a correct answer, but it is guaranteed that the randomized algorithm outputs a correct answer with a target probability. Despite the weaker output guarantee, randomized algorithms are, more often than not, much simpler than deterministic algorithms for many problems and have thus wide applications. This course will focus</p>				

	<p>on randomized algorithms and probabilistic analysis of algorithms. Some algorithms, especially those related to big data, often see in their analysis a phenomenon called ‘concentration of measure’, which lies in the core of modern probability theory. Simply put, the phenomenon depicts the ‘deterministic outcome’ shown by a large number of random quantities via their interaction, analogous to the deterministic physical laws at the macroscopic scale shown by a swarm of molecules with random motions. This course will cover some topics in concentration of measure phenomenon and related applications.</p>					
课程教学大纲 (course syllabus)						
*学习目标(Learning Outcomes)	<ol style="list-style-type: none"> <li>1. 学生能了解基本的概率方法在算法设计中的思想</li> <li>2. 学生能理解基本的测度集中现象，并能利用该现象设计/分析算法</li> <li>3. 学生能解决基本的 balls into bins 问题，并能以此分析相关随机算法</li> <li>4. 学生能了解基本的 Markov 链和 expander 图知识及其在算法设计与分析中的应用</li> </ol>					
*教学内容、进度安排及要求 (Class Schedule & Requirements)	教学内容	学时	教学方式	作业及要求	基本要求	考查方式
	随机算法	9	课堂			作业
	测度集中	12	课堂			作业
	随机过程	11	课堂			作业
*考核方式 (Grading)	4 次作业, 每次 25%					

<p>*教材或参考资料 (Textbooks &amp; Other Materials)</p>	<ol style="list-style-type: none"> <li>1. Mitzenmacher and Upfal. Probability and Computing: Randomized Algorithms and Probabilistic Analysis. Cambridge University Press, 2005</li> <li>2. Dubhashi and Panconesi. Concentration of Measure for the Analysis of Randomized Algorithms. Cambridge University Press, 2012</li> </ol>
<p>其它 (More)</p>	
<p>备注 (Notes)</p>	

备注说明：

1. 带\*内容为必填项。
2. 课程简介字数为 300-500 字；课程大纲以表述清楚教学安排为宜，字数不限。