UNIVERSITY OF CALIFORNIA
UCMERCED

Syllabus for EECS279-01: Approximation Algorithms

Fall 2017
Instructor: Sungjin Im

Designation:	
Catalog Description:	Optimization problems are prevalent in many disciplines, and computer science is no exception. Unfortunately, numerous optimization problems are computationally hard (eg. NP-hard), hence resist efficient algorithms. Approximation algorithms are polynomial time heuristics that aim to give a solution close to the optimum for all inputs. Although the focus is on guaranteeing the solution quality even in the worst scenario, the algorithmic ideas developed for approximation algorithms can be readily turned into useful heuristics in practice. The area of approximation algorithms has been a central topic in theoretical computer science, and now has a rich body of beautiful theories.
Text Books and Other Required Materials:	Textbook: - The Design of Approximation Algorithms by David Williamson and David Shmoys, Cambridge University Press, 2011. Online (but non-printable) version is available: http://www.designofapproxalgs.com/download.php Another useful reference: - Approximation Algorithms by Vijay Vazirani, Springer-Verlag, 2004.
Course Objectives/ Student Learning Outcomes:	Students learn approximation algorithms for various optimization problems. Objectives are: - To provide a solid background on the pertinent computer science, mathematical, and electrical engineering concepts that make up the foundations of the discipline of electrical engineering and computer science engineering, as well as their closely associated fields. - To provide students with the knowledge to correctly apply the laws of nature to the creative formulation and solution of engineering problems through the use of analytical, computational and experimental techniques. - To expand the research of electrical engineering and computer science to non-traditional areas by continually seeking to incorporate new methodologies and research findings to our graduate curriculum.
Program Learning Outcomes:	
Prerequisites by Topic:	CSE 100: Algorithm Design and Analysis, or an equivalent course.
Course Policies:	
Academic Dishonesty Statement:	a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work. b. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or

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	part of work done by someone else, in the form of an e mail, an e mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action. c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.
Disability Statement:	Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.
Topics:	1. Approximation algorithm design techniques: Greedy approach, dynamic programming, randomization, local search, linear programming and rounding, semi-definite programming and rounding, and metric embedding. 2. Fundamental approximation problems: - Covering problems: vertex cover, knapsack cover, and set cover - Scheduling problems: single/multiple machine scheduling, precedence constraints, and generalized assignment - Packing problems: bin packing, knapsack, max coverage, and max independent set - Submodular optimization and its applications - Clustering: k-center, k-median, k-means, and facility location - Tour problems: metric TSP, asymmetric TSP, and orienteering - Network design problems: Steiner trees/forests, and survival network design - Cut problems: max cut, multiway cut, multicut, sparsest cut - Routing problems: multicommodity flow, congestion minimization, unsplittable flow 3. Introduction to inapproximability: several well-known inapproximability results and approximation-preserving reduction Topics are subject to change.
Class/laboratory Schedule:	Lecture: 10:30-11:45pm, Tuesday and Thursday, CLSSRM 274
Midterm/Final Exam Schedule:	Final exam: 3:00-6:00pm, Dec. 9, CLSSRM 274
Course Calendar:	
Professional Component:	
Assessment/Grading Policy:	There will be five assignments, each worth 15% and a final exam which is worth 25%.

Designation:	
Coordinator:	Sungjin Im
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Office Hours:	TBD.