

COT 5442: APPROXIMATION ALGORITHMS

SYLLABUS

"Although this may seem a paradox, all exact science is dominated by the idea of approximation."
Bertrand Russell

BASIC INFO

- **Course number:** COT5442
- **Semester:** Spring 2011
- **Schedule:** Tue 9:35am-11:30am
Thu 10:40am-11:30am
- **Location:** CSE 221
- **Professor:** Alper Üngör
E534 CSE Building
ungor@cise.ufl.edu
- **Office hours:** Thu 1pm-3pm
- **Credit hours:** 3
- **Web-page:** <http://www.cise.ufl.edu/class/cot5442sp11>
- **Prerequisites:** COT5405 with a grade of A or A-.



World TSP

MAIN THEME

Approximation algorithms have been developed in response to the impossibility of solving a good many problems exactly. In the case of NP-Complete problems, we sacrifice optimality in favor of a “good” solution that can be computed efficiently. Trading-off optimality in favor of tractability is the paradigm of approximation algorithms. This course will cover the fundamental concepts in approximation algorithms.

<i>Concepts, Methods</i>	<i>Application Domains</i>
<i>Hardness</i>	<i>Covering, Packing, Clustering</i>
<i>Graph theory</i>	<i>Cutting, Coloring, Counting</i>
<i>Greedy methods</i>	<i>Geometric problems</i>
<i>Rounding</i>	<i>Computational biology</i>
<i>LP-relaxation</i>	<i>Computer graphics</i>
<i>Semidefinite programming</i>	<i>Network problems</i>
<i>Primal-dual schema</i>	<i>Operations research</i>
<i>Randomized algorithms</i>	<i>Scheduling, Facility location</i>

COURSEWORK

Grades will be based on homeworks (30%), a project (30%), and two exams (40%).

- **Homework:** Expect to have 4-5 assignments, each consisting of 4-6 problems and 1-2 programming assignment.
- **Project:** Each student is expected to select a topic to investigate it in great depth. This involves
 1. reading several papers on this topic;
 2. identifying and attempting to solve open problems on this topic and/or designing and running an experimental study;
 3. giving an informative presentation in class;
 4. writing a short survey paper on this topic.
- **Exam:** There will be two in-class exams (tentatively on Mar 1 and Apr 19) each worth 20% of your grade.
- **Attendance:** Class participation is encouraged. Attendance is required. Each student is expected to provide a summary and assessment of others' project presentations.

COURSE MATERIAL

- **Recommended Textbooks:**
 1. *Approximation Algorithms*. V. Vazirani, (Springer, 2001).
 2. *The Design of Approximation Algorithms*. D.P. Williamson and D.B. Shmoys, (Cambridge University Press, 2011), Online version.
 3. *Approximation Algorithms for NP-Hard Problems*. D.S. Hochbaum, (PWS, 1997).
 4. *Computers and Intractability*. M. R. Garey and D. S. Johnson, (Freeman, 1979).
 5. *Introduction to Algorithms (3rd ed)*., T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, (MIT Press, 2009).
- **Conferences:** STOC, FOCS, SODA, APPROX, RANDOM, SoCG, LATIN, ESA
- **Journals:** Journal of Algorithms, Algorithmica, Theoretical Computer Science, SIAM Journal on Computing, Journal of the ACM, International Journal of Computational Geometry and Applications, Computational Geometry : Theory and Applications
- Also watch the class web page for other survey and research papers, links, etc.

TENTATIVE TIMELINE

Date	Lecture Topic
Jan 6 Th	Syllabus, Course structure, Introduction
Jan 11 Tu	<i>No Class - DoE Panel in D.C.</i>
Jan 13 Th	<i>No Class - DoE Panel in D.C.</i>
Jan 18 Tu	Set Cover
Jan 20 Th	Steiner Tree and TSP
Jan 25 Tu	Multiway cut and k-cut
Jan 27 Th	k-center
Feb 1 Tu	Feedback vertex set
Feb 3 Th	Shortest superstring
Feb 8 Tu	Knapsack
Feb 10 Th	Bin Packing
Feb 15 Tu	Minimum Makespan Scheduling
Feb 17 Th	Euclidean TSP
Feb 22 Tu	LP Duality
Feb 24 Th	Set cover via dual-fitting
Mar 1 Tu	Midterm Exam
Mar 3 Th	Rounding
Mar 8 Tu	<i>Spring Break</i>
Mar 10 Th	<i>Spring Break</i>
Mar 15 Tu	Primal-dual schema
Mar 17 Th	Scheduling on unrelated parallel machines
Mar 22 Tu	Multicommodity flow
Mar 24 Th	Multicut in General Graphs
Mar 29 Tu	Steiner Forest
Mar 31 Th	Steiner Network
Apr 5 Tu	Facility Location
Apr 7 Th	k-Median
Apr 12 Tu	Semi-definite programming
Apr 14 Th	Approximate Voronoi diagrams
Apr 19 Tu	Final Exam

OTHER ISSUES

- **Announcements:** Students are responsible following the announcements on the course web-page (<http://www.cise.ufl.edu/class/cot5442sp11>). Schedule updates regarding the homeworks, exams and office hours will appear on the web-page.
- **Accommodations for Students with Disabilities:** Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.
- **The University's Honesty Policy:** All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others.
The following links contain additional information relating to academic honesty:
 - <http://lss.at.ufl.edu/services/turnitin/resources.html>
 - <http://www.dso.ufl.edu/judicial>