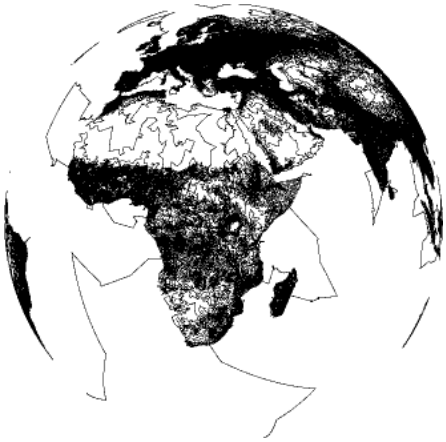
CIS 6930: APPROXIMATION ALGORITHMS

SYLLABUS

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

BASIC INFO

- **Course number:** CIS6930
- **Semester:** Fall 2005
- **Schedule:** Tue 10:40am-11:30am
  Thu 10:40am-12:35pm
- **Location:** Turlington 2328
- **Professor:** Alper Üngör
  E430 CSE Building
  ungor@cise.ufl.edu
- **Office hours:** Tue 11:30am-12:30pm
  Thu 12:35pm-13:35pm
- **Catalog number:** 3993
- **Credit hours:** 3



World TSP

- **Web-page:** `http://www.cise.ufl.edu/~ungor/courses/fall05`
- **Prerequisites:** COP 3530 or equivalent, or Instructor's permission

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.

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

Coursework

Grades will be based on homeworks (40%), a semester project (30%), and an exam (30%).

- **Homework:** There will be 4-5 assignments, each consisting of 4-6 problems. There will be 2 programming assignments.
- **Project:** A one-page project proposal should be submitted by the fifth week of the semester. A literature review paper should be written by the tenth week of the semester. Final project reports are due by the last week of the semester. Projects will be presented on the last two weeks of the semester.
- **Exam:** There will be an in-class final exam, tentatively on the second last week of teaching.
- **Attendance:** Class participation is strongly encouraged as bonus points will be awarded.

Course Material

- **Recommended Textbooks:**
  1. *Approximation Algorithms.* V. Vazirani, (Springer, 2003).
  2. *Approximation Algorithms for NP-Hard Problems.* D.S. Hochbaum, (PWS, 1997).
  3. *Computers and Intractability.* M. R. Garey and D. S. Johnson, (Freeman, 1979).
  4. *Introduction to Algorithms (2nd ed).*, T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, (MIT Press and McGraw-Hill, 2001).
  5. I will also distribute other papers and sources.
- **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	Assignments
Aug 25 Th	Syllabus, course structure, introduction, project ideas	HW#0 out
Aug 30 Tu	Set Cover	HW#1 out
Sep 1 Th	Steiner Tree and TSP	
Sep 6 Tu	Multiway cut and k-cut	
Sep 8 Th	k-center	HW#1 due
Sep 13 Tu	Feedback vertex set	PA#1 out
Sep 15 Th	Shortest superstring	HW#2 out
Sep 20 Tu	Knapsack	
Sep 22 Th	Bin Packing	
Sep 27 Tu	Scheduling	HW#2 due
Sep 29 Th	Euclidean TSP	Proposals due
Oct 4 Tu	Projects discussion	HW#3 out
Oct 6 Th	LP duality	PA#1 due
Oct 11 Tu	Set cover via dual-fitting	PA#2 out
Oct 13 Th	Rounding	HW#3 due
Oct 18 Tu	Primal-dual schema	
Oct 20 Th	Scheduling on unrelated parallel machines	HW#4 out
Oct 25 Tu	Multicommodity flow	
Oct 27 Th	Steiner Forests and Networks	PA#2 due
Nov 1 Tu	*SIAM Geometric Design and Computing*	HW#4 due
Nov 3 Th	*SIAM Geometric Design and Computing*	
Nov 8 Tu	Facility Location	HW#5 out
Nov 10 Th	k-Median	
Nov 15 Tu	Semi-definite programming	
Nov 17 Th	Approximate Voronoi diagrams	HW#5 due
Nov 22 Tu	Projects	
Nov 24 Th	*THANKSGIVING BREAK*	
Nov 29 Tu	Projects	
Dec 1 Th	Final Exam	
Dec 6 Tu	Projects	Projects due

Other Issues

- **Announcements:** Students are responsible following the announcements on the course web-page (`http://www.cise.ufl.edu/~ungor/courses/fall05`). 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`