Advanced Discrete Optimization & Networks

Prerequisites: CS 4414 or CS 5433 or permission of instructor
Instructor: K. Thulasiraman, DEH 235 thulasi@ou.edu, 325-0566 (Phone)

Discrete optimization problems abound in everyday life. This course will focus on those discrete optimization techniques and methodologies which have served as powerful tools in the solution of problems in a variety of applications: telecommunications and transport network design, VLSI circuit design, data analysis, etc. The first part of this course will focus on techniques and methodologies and the second part on special topics and recent advances in the networking area. The course will help students gain an in-depth training in modern trends in discrete optimization as well as offer opportunities to identify and explore new directions of research. The topics to be covered will depend on the students' needs and preparation. The following outline will serve as a guideline:

- Review of Shortest Paths Algorithms
- Min cost-flow problems
  - Optimality Criterion
  - Network simplex Method
  - Primal-dual and relaxation methods
- Maximum flow problem
  - Max-Flow Min Cut Theorem
  - Dinic-PM algorithm
  - Goldberg-Tarjan Preflow Push Algorithm
  - Maximum Flows in 0-1 networks and computational complexity
- Connectivity
  - Menger's theorems
  - Vertex and Edge connectivity algorithms
- Matching:
  - Bipartite matching
  - Optimum assignment problems
- Eulerian Graphs and Postman Tours
- Integer Programming Formulations for Discrete Optimization Problems
- Coping with NP-Completeness:
  - Constrained Shortest Paths
  - Disjoint Paths
- More Advanced Topics, if time permits.

References:
- Class Notes

Course Assessment
2 Tests: 60%
Project: 40%

Project: Each student must submit a topic of study and have it approved by the instructor before February 6, 2013. A report on the study must be submitted before April 15, 2013. Oral presentation of the report will be scheduled in the last week of classes in May.
SCHOOL OF COMPUTER SCIENCE

Tests: In addition to the final exam, there will be two tests during the term. The dates for the test will be announced in class. Missing a test without a previously approved excuse will result in a grade of zero for that test.

Grading: There are four components to the course grade. They are weighted as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Tests (2)</td>
<td>50</td>
</tr>
<tr>
<td>Homework</td>
<td>20</td>
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<tr>
<td>Final Exam</td>
<td>30</td>
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</tbody>
</table>

The grading scale will be no higher than the following. It may be lower at the discretion of the instructor.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>90+</td>
</tr>
<tr>
<td>B</td>
<td>80-89</td>
</tr>
<tr>
<td>C</td>
<td>70-79</td>
</tr>
<tr>
<td>D</td>
<td>55-69</td>
</tr>
<tr>
<td>F</td>
<td>Otherwise</td>
</tr>
</tbody>
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Academic Misconduct: All work submitted for an individual grade, such as homework and projects should be the work of that single individual, not their friends or their tutor. Students who fail to do their own work not only violate the Code of Conduct for the University of Oklahoma, but also may fail to learn critical learning objectives for the class.

- Do not show another student a copy of your homework or projects before the submission deadline.
- Do not email your project to another student, even if they promise they will not copy it.
- The penalties for knowingly permitting your work to be copied are the same as the penalties for copying someone else’s work.

Upon the first documented occurrence of collaborative work, I will report the academic misconduct to the Campus Judicial Coordinator. The procedure to be followed is documented in the University of Oklahoma Academic Misconduct Code. In the unlikely event that I elect to admonish the student, the appeals process is described re: [http://integrity.ou.edu/summary_of_the_process.html](http://integrity.ou.edu/summary_of_the_process.html).

Accommodation of Disabilities: Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact me personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate his or her educational opportunities.

Adjustments for Pregnancy/Childbirth Related Issues:

Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact me as soon as possible to discuss. Generally, modifications will be made where medically necessary and similar in scope to accommodations based on temporary disability. Please see [http://www.ou.edu/content/ooe/pregnancyfaq.html](http://www.ou.edu/content/ooe/pregnancyfaq.html) for commonly asked questions.

Title IX Resources:

For any concerns regarding gender-based discrimination, sexual harassment, sexual misconduct, stalking, or intimate partner violence, the University offers a variety of resources, including advocates on-call 24/7, counseling services, mutual no contact orders, scheduling adjustments and disciplinary sanctions against the perpetrator. Please contact the Sexual Misconduct Office 405-325-2215 (8-5) or the Sexual Assault Response Team 405-615-0013 (24/7) to learn more or to report an incident.