Course Syllabus

Course Information

CS6385 Algorithmic Aspects of Telecommunication Networks, Section 001
Cross listed as TE 6385.

Spring Semester, 2017

Professor Contact Information

Name: Dr. Andras Farago, Professor
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Teaching Assistant: When the TA is assigned, will be posted under "Announcements" at the course website in e-Learning.

Catalog Pre-requisites for the course:

CS 5343 Algorithm Analysis & Data Structures
CS 5348 Operating Systems Concepts
TE 3341 Probability Theory and Statistics or equivalents.

Course Description

Purpose and content of the course: The purpose of the course is to make students familiar with fundamental methods in the design and analysis of telecommunication networks. The main emphasis is on the methodology that remains valid on the long term and does not depend strongly on frequently changing applications.

Outline of topics to be addressed: introduction to the network planning problem; mathematical programming for planning; network algorithms for planning; elements of network reliability; optimization for network design; network data analysis; selected topics from link level and network level traffic modeling and analysis for traffic engineering.

More detailed topic list

Note: The list is tentative, some topics may be skipped, new ones may be added.

- Fundamental concepts of network planning; Typical problems and issues in network design; Analysis vs. synthesis; Reasons for hardness in network planning; Decomposition approach to mitigate hardness; Pathways to optimum design: exact, approximate, heuristic.

- Optimization in network design; Linear Programming: formulation, solution principles, duality, network planning related applications; Integer Linear Programming: formulation, methods for linearizing non-linear integer programs, solution principles, exact and heuristic algorithms for integer programs, network design related applications.

- Graph algorithms for network design; maximum flow; minimum cost flow; multicommodity flow; flow based network design; network vulnerability analysis via graph connectivity; structure of optimally connected graphs under uniform costs, various theorems and algorithms related to graph connectivity; Karger's randomized contraction algorithm for minimum cut, Nagamochi-Ibaraki minimum cut algorithm. Outlook to recent new results.

- Algorithms and models for reliability analysis; Reliability concepts; Basic reliability configurations; More complex reliability configurations; Algorithms to compute exact and approximate network reliability; Lifetime measures; Computing network lifetime measures in various settings.

- Traffic analysis for network planning; Integrating flow and queuing models in network planning to capture traffic considerations; Link capacity dimensioning for given flow and network topology; Flow routing for given topology and link capacities; Combined capacity and flow assignment when only the network topology and the traffic demand is given; Heuristic methods for optimizing capacities, flow routing, and network topology together, when only the traffic matrix is known; Blocking probability models at the link level, and at the network level; Reduced load approximation and the Erlang fixed point equations (optional).

Student learning objectives, outcomes

Learning objectives		Outcomes (see explanation under the table)
Fundamental concepts of network planning		b,c
Optimization in network design		a,b,c,d,e
Graph algorithms for network design		a,b,c,e
Algorithms and models for reliability analysis		a,b,c,e
Traffic analysis for network planning		a,b,c

Outcomes

a. an ability to understand advanced concepts in theory of computer science;
b. an ability to understand advanced concepts in applications of computer science;
c. an ability to apply knowledge of advanced computer science
    to formulate and analyze problems in computing and solve them;
d. an ability to learn emerging concepts in theory and applications
    of computer science; and,
e. an ability to design and conduct experiments as well as to analyze
    and interpret data.

Required text:

Lecture notes written by the instructor. They are available online at the course website in eLearning. The lecture notes may be updated during the semester.
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Projects/Assignments & Academic Calendar

There will be programming projects and assignments. Their number will be announced during the semester.

There will be one exam at the end of the semester.

Due dates of projects and assignments: will be announced and posted in eLearning.

Exam date: Wednesday, April 26, 2017.

Grading Policy

Item (All scores will be normalized to the range 0…100)	Weight
Project average	40 %
Assignment average	30 %
Exam	30 %

The weights, as well as the number of projects and assignments may be changed at the professor's discretion. Bonus points may be assigned for outstanding performance and active class participation. Missed items count with 0 score. For late submission policy see Course & Instructor Policies below.

Department Policy on absences

- Three consecutive undocumented absences result in an *automatic* drop of the letter grade by one letter. For example, an A grade is dropped to B, an A- is dropped to B-, a B+ is dropped to C+, etc. Note that a C grade is dropped to F, since that is the next lower grade for graduate courses. This policy applies to any three consecutive classes, even if they are the first classes in the semester. (One of the goals of this policy is to discourage students from coming back late to the beginning of the semester.)

- Four consecutive undocumented absences result in *automatic* failure (F grade) in the course.

- Consecutive classes are defined as classes with no other class meetings in between. For example, the last class before the Spring Break, and the first class after the Spring Break are consecutive, since there are no class meetings between them.

The general goal of this policy is to encourage students for regular attendance. Note that this is *Department Policy*, the individual instructors cannot override it.

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Course & Instructor Policies

Class participation: To enforce the Department Policy on absences, a sign-up sheet will be used in every class meeting. It will also be used to evaluate class participation, which may be factored into the final grades.

Course website: Project and assignment submissions will be done via the course website in eLearning. Announcements, deadlines, and any other course related information will also be posted there. Check the course website regularly. E-mail notifications will be sent from eLearning. According to UTD e-mail policy, please use your UTD e-mail for course related correspondence. Do not use private e-mail addresses, such as gmail, yahoo, etc., for this purpose. It is your responsibility to check your e-mail regularly and to make sure that your mailbox is not full, so that the messages do not bounce.

Late submission policy: Late submissions will receive reduced points. The reduction amount depends on how late the submission is (it can reach 100 % reduction). The only exception is a late submission due to *documented* emergency, with instructor's approval. In that case an extended deadline can be given.

Note: Please do not confuse emergency with convenience!

Typical examples of acceptable emergency reasons are: disease, family emergency, accident, and similar reasons, proved with appropriate documentation.

Examples of *unacceptable convenience reasons:* "I would like to travel and this is the best date for it ..." Or: "I have a job interview which collides with the date..." Or: "I had to stay up very late at night, causing me to oversleep in the morning, so I missed the class, but I promise it will not happen again…" Or: "I was very busy recently with other courses, so I could not finish the project, could I get a deadline extension?"

For information on withdrawals, incompletes, academic honesty and other matters of general interest please consult the Graduate Catalog. As a matter of critical importance, I would like to emphasize that plagiarism, collusion or any form of cheating is considered academic dishonesty and is subject to serious academic penalty.

Important note: *All work in this course is individual, there is no group work.*

Regular class attendance and participation is strongly encouraged. Note that there is a strong positive correlation between regular class attendance and good performance. If a student chooses not to attend a class, or arrives late, he/she is solely responsible for missing any explanations, handouts, announcements, supplementary material, preparatory exercises for exams and contents of the lecture. Most of the auxiliary material will be posted on the course website in e-Learning, but not necessarily everything. *Note that the explanations given in the class meetings greatly contribute to the understanding of the material, which may be significantly harder using only the written notes.*

The course policies and timelines are subject to change at the discretion of the Professor.

University Policies

Student Conduct & Discipline

The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD publication, *A to Z Guide*, which is provided to all registered students each academic year.

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the *Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3*, and in Title V, Rules on Student Services and Activities of the university's *Handbook of Operating Procedures*. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391).

A student at the university neither loses the rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.

Academic Integrity

The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.

Scholastic dishonesty includes, but is not limited to, statements, acts or omissions related to applications for enrollment or the award of a degree, and/or the submission as one's own work or material that is not one's own. As a general rule, scholastic dishonesty involves one of the following acts: cheating, plagiarism, collusion and/or falsifying academic records. Students suspected of academic dishonesty are subject to disciplinary proceedings.

Plagiarism, especially from the web, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course may use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.

Withdrawal from Class

The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog and academic calendar. Administrative procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, the instructor cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose not to attend the class once you are enrolled.

Incomplete Grade Policy

As per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of **F**.

Disability Services

The goal of Disability Services is to provide students with disabilities educational opportunities equal to those of their non-disabled peers. It is managed by the Student AccesAbility Office, which is part of the Office of Student Affairs. Further details and contact information can be found at http://www.utdallas.edu/studentaccess/

It is the student's responsibility to notify his or her professors of the need for special accommodation. This has to be initiated through the Student AccesAbility Office that provides students with letters to present to faculty members to verify that the student has a disability and needs special accommodations.

Have a useful and enjoyable course!