MATH 8160 Section 1
Network Algorithms and Data Structures

Course Syllabus (Spring 2019)

Instructor: Matthew Saltzman
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Office Hours: MTWThF 9:00–10:00 or by appointment

Class Time/Room: TTh 2:00–3:15pm, Martin E-005

Description: We will study the basic ideas for developing data structures and algorithms for optimization problems on graphs and networks. These data structures are key to understanding and improving the technology that surrounds us and that uses highly sophisticated and efficient algorithms running on very large networks (sometimes with millions of nodes). Minor changes in a data structure can change its complexity class and make it applicable on very large instances

Learning Objectives: The successful student will develop data structures and the associated algorithms for various problems arising in network applications, such as: solving flow problems (min-cost-flow, max-flow, shortest path), finding graph characteristics (chromatic number, maximum stable set, etc.), solving problems on trees and manipulating graphs, both directed and undirected. The student will be capable of analyzing the complexity of the algorithms designed and will be able to implement them in a programming or scripting language.

Prerequisites: A thorough understanding of linear programming, as covered in MATH 6400 or MATH 8100. Familiarity with graphs and networks, as covered in MATH 8140 and/or MATH 8530. Experience with a procedural computer language such as Python, C, C++, Java, Matlab, as covered in MATH 8600 or similar. Familiarity with statistical analysis is helpful. Familiarity with data structures, as covered in MATH 8650 is helpful.

Textbooks: Required:

- J. P. Jarvis and D. R. Shier, *Notes on Graph Algorithms*, available from the Campus Copy Shop, Rt. 93.
- R. E. Tarjan, *Data Structures and Network Algorithms*, SIAM Press, 1983, order from `http://bookstore.siam.org/cb44/`.

Recommended:

- R. K. Ahuja, T. L. Magnanti, and J. B. Orlin, *Network Flows*, Prentice Hall, 1993.

Other references will be suggested as they are relevant. Some will be Web-based, some will be on reserve, some will be handed out.

Grading:

Programming projects	$5 \times 20\%$
Total	100%

Ground Rules:

Attendance: You are strongly encouraged to attend class. You are responsible for material covered in lectures. The class time is your primary opportunity to clarify points of difficulty, learn about the instructor's expectations on tests, and get help with problems. It is also the best time for the instructor to get to know you, which in most cases is to your benefit. Finally, you get assignments, turn them in, and take pop quizzes in class, so class attendance can have a direct effect on your grade.

If the instructor or a substitute has not arrived within 15 minutes of the scheduled class time, you may assume that class has been canceled.

Any exam that was scheduled at the time of a class cancellation due to inclement weather will be given at the next class meeting unless contacted by the instructor. Any assignments due at the time of a class cancellation due to inclement weather will be due at the next class meeting unless contacted by the instructor. Any extension or postponement of assignments or exams must be granted by the instructor via email or Blackboard within 24 hours of the weather related cancellation.

Use of laptops, tablets, cell phones, etc., during class is not permitted other than for note-taking, reference, or as directed for designated in-class activities.

Assignments: Homework may be assigned each class. Although I will not always collect assignments, you are welcome to turn in any solutions on which you would like comments. I will give assignments to turn in regularly. Late assignments will be docked 20% per day. Homework assignments formatted in LaTeX may be turned in one day after the due date with no penalty.

You are encouraged to work with your classmates on homework assignments, but you are expected to write up and turn in your own solutions. See the note on outside sources, below.

Exams: There will be *no* makeup exams. Missed exams will be given a grade of zero. The *only* exception to this policy will be absence for verifiable medical reasons.

Final Grades: Final letter grades will be based on percentage scores on homework, tests, and projects. Minimum grades will be awarded according to the following schedule:

Percentage	≥ 90	≥ 80	≥ 70	≥ 60	< 60
Grade	A	B	C	D	F

Academic Integrity Policy: As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity.

The academic integrity policy can be found at `http://gradspace.editme.com/AcademicGrievancePolicyandProcedures#intergritypolicy`

Disability Access It is university policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students with disabilities requesting accommodations should make an appointment with Disability Services (656-6848) to discuss specific needs within the first month of classes. Students should present a Faculty Accommodation Letter from Student Disability Services when they meet with instructors. Accommodations are not retroactive and new Faculty Accommodation Letters must be presented each semester.

Sexual Harassment Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The policy is located at `http://www.clemson.edu/campus-life/campus-services/access/non-discrimination-policy.html`. Jerry Knighton serves as Clemson's Title IX coordinator and he may be reached at `mailto:knightl@clemson.edu` or 656-3181.

A note on outside sources: It is in the nature of an introductory course that everything you will be asked to do for homework, exams or projects has been done before. The original papers and other textbooks that contain solutions may be available in the library or from other students or faculty. Computer codes may be available in these places or via the Internet. In the interest of your own education and in fairness to other students, it seems necessary to provide some ground rules for the use of outside sources.

- Before going to an outside source, you should make a good-faith effort to solve the problem on your own. This is the best way to learn the material, and to find out what you really know and don't know.

- If you do find the solution in an outside source, you should acknowledge the source. This is only fair to the original author, whether we're talking about a book, monograph, online source, or even a faculty member or fellow student. Failure to disclose your sources is plagiarism.
- If you use an outside source, don't copy the result (proof, program, solution) verbatim. Rewrite it in your own words; improve the notation, construct a new example, reorganize the code, etc.. This will maximize the benefit to you of the experience of finding a solution in existing literature.
- Don't check out original sources (particularly journal articles and monographs) from the library during take-home exams. This is only fair to other students in the class who may be led to the same source.