MATH 8140 Network Flows
Course Syllabus, Fall 2018

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Office Hours: TBA

Class Time/Room: TTh 2:00–3:15pm, Martin E-5

Description: This course is mainly concerned with the study of network flow problems, both as specially-structured linear programs and as combinatorial problems in their own right. The characteristics and properties of network flow problems will be discussed. Solution procedures will be developed, exploiting the special structure of network problems. Other topics might include LP decomposition methods with application to multicommodity flow and side constraints, and related combinatorial problems and algorithms.

Prerequisites: MATH 8100 or 4400/6400 or equivalent is desirable but not required—some exposure to general linear programming, the simplex method, and LP duality is expected. Knowledge of a programming language—such as Java, C, or Python—is expected; familiarity with the material in an undergraduate data structures course will also be useful. A student whose knowledge of linear programming is limited to the material in MATH 4400/6400 may need to work a little harder to make up some deficiencies.

Textbook: R. Ahuja, T. Magnanti, and J. Orlin, *Network Flows*, Prentice Hall, 1993 (required).

D. R. Shier, *MATH 8140 Course Notes*, 200+ pages, available at Campus Copy Shop, Route 93, Clemson (recommended).

Several other books will be on reserve in the library. Other sources will be indicated where relevant.

Recommended Software: Netflow, AMPL/CPLEX/Gurobi, MPL, Matlab. Instructions on obtaining software will be given in class.

Topics (tentative):

- Review of LP and basic network concepts
- Shortest paths
- Maximum flows
- Min-cost flows

- Transportation and assignment problems
- Selected topics from: Matchings, spanning trees, multicommodity flow, networks with side constraints, generalized networks, network extensions

Learning Outcomes: Upon successful completion of this course, students will be able to:

- recognize applications that can be modeled as network flow problems and formulate instances of those problems;
- analyze computational complexity of network algorithms presented as pseudocode;
- execute the steps of several algorithms for shortest path, maximum flow, minimum-cost flow, and other network problems;
- use computer modeling languages and solvers to find solutions to network problems.

Grading:

Homework	30%
Two midterm exams	$2 \times 20\%$
Final Exam (cumulative)	30%
Total	100%

Assignments and exams: Homework will be assigned each class. Problems to be turned in for grades will be designated when assigned. You are strongly encouraged to attempt to work problems that are not assigned for a grade as well. You are welcome to turn in any solutions on which you would like comments. Discussion and collaboration on homeworks is acceptable, however you should write up and turn in your own solutions. Typeset homework (LaTeX preferred but not required) may be turned in one day after the due date. Extensions for one day may be granted in unusual circumstances, if arranged in advance.

Attendance: Students are expected to attend class regularly and punctually. If the instructor does not arrive within 15 minutes after the designated start time, class is considered dismissed.

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, other textbooks that contain solutions, and computer codes may be available in the library or from other students or faculty or on the internet. In the interest of your own education and in fairness to other students, here are 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 or even a 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. Remember, not everything you read on the internet is true.
- 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.

Academic Integrity 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.

Disability Access Students with disabilities requesting accommodations should make an appointment with Dr. Arlene Stewart (656-6848), Director of Disability Services, 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, veterans 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. This policy is located at `http://www.clemson.edu/campus-life/campus-services/access/title-ix/`. Mr. Jerry Knighton is the Clemson University Title IX Coordinator. He also is the Director of Access and Equity. His office is located at 111 Holtzendorff Hall, 864.656.3181 (voice) or 864.565.0899 (TDD).