MATH 380 - Algebraic Graph Theory (Fall 2017)

Department of Mathematics

State University of New York at Geneseo

Instructor Coordinates

Instructor	Dr. Cesar O. Aguilar
Office	South Hall 325A
Email	aguilar@geneseo.edu
Phone	585-245-5398
Office Hours	See course website

Course Coordinates

Course Title	MATH 380 - Algebraic Graph Theory, (CRN 19381)
Pre-Requisite	MATH 233 and MATH 239
Term	Fall 2017
Course Website	www.geneseo.edu/~aguilar
Textbook	I will provide notes of all the material. *Combinatorics and Graph Theory*, Harris, Hirst, and Mossinghoff, 2nd
Textbook Sections	1.1-1.3, 1.6 (Harris, Hirst, Mossinghoff)
Meeting Times	MWF 12:30-1:20, South 328

Course Description

Introduction to graph theory using linear algebraic techniques; graphs, subgraphs, graph connectivity, paths, cycles, regular and bipartite graphs, trees, isomorphic graphs and graph automorphisms, adjacency and Laplacian graph matrices, spectral graph theory, Laplacian spectral changes under graph operations, equitable partitions, applications such as PageRank and controllability of dynamic networks. The software Python will be used in the labs and assignments to illustrate the theory.

Learning Outcomes

Upon successful completion of this course, a student will be able to:

- Be conversant with the rudiments and vocabulary of the topic,
- Be able to solve routine problems specific to the topic,
- Be able to state main theorems and results of the topic,
- Be able to provide several examples of special classes of graphs, and
- Give examples of the real-world applications of graph theory

Pre-Requisites

We will make extensive use of linear algebra (especially eigenvector/eigenvalue analysis) and will prove many of the theorems that we will encounter and use. For these reasons, students will need MATH 233 (Linear Algebra) and MATH 239 (Proofs) to be admitted in the course.

Grading Scheme

Below is the **tentative** course grading scheme. The grading scheme may change during the semester at the discretion of the instructor. Any changes to the grading scheme will be announced in class before the final exam.

Grading scheme

Item	Percentage
Homework	20
Tests	30
Report & Presentation	20
Final Exam	30

Calculation of final letter grade

Grade	Percentage
A	94-100
A−	90-93
B+	87-89
B	83-86
B−	80-82
C+	77-79
C	73-76
C−	70-72
D+	67-69
D	63-66
D−	60-62
E	< 60

Tests and Exam

There will be three in-class tests and are tentatively scheduled for Weeks 4, 7, and 13. The Final Exam is scheduled for **December 19, 2017, 3:30 - 6:00 pm, South 328**. **Unless a student can present evidence of extenuating circumstances, there will be no make-up tests or exams.**

Presentation & Report

Students will be divided into groups of two and each group will present a topic closely related to the course but on material not directly covered in the course. Such a topic could be chosen from several undergraduate level journal papers that will be provided by the instructor or the topic can be chosen by the student. Each group will write a summary of their topic in the form of a report. The presentations will be held during the last week of class and the report is due on the last day of class.

Assignments Policy

Homework assignments will contain a combination of routine computational exercises, in-depth exercises possibly involving short proofs, and exercises that require Python. Homework assignments are to be handed in at the beginning of class on the day that they are due. **Late homework assignments will not be accepted.** I encourage you to collaborate with your colleagues on your homework assignments but your final written work should be your own (see Academic Dishonesty statement below).

Reading Mathematics

Learning to read mathematics on your own will be an important skill that you will further develop in this course. Because I will not be able to cover in the lectures all the material that you will be required to learn, **you will need to do a lot of independent reading before and after the lectures**. Reading in advance the section that we will cover in the lectures will payoff immensely with your understanding of the material and it will allow you to ask questions during the lectures. You are not expected to grasp every new concept that you are introduced to in the lectures, and so reading in advance will help you understand new material more quickly.

FREE Study Tips

Below are recommended study tips to perform weekly:

1. Before a lecture, **read the textbook/notes section** that will be covered (see course website for lecture schedule). As you read, write down questions that you have and ask them during the lecture if they haven't

been answered by the lecture presentation.

2. During lectures, **take good notes and ask your questions** when the appropriate time comes. Everything that will appear in the tests will come directly from the lecture notes and so your notes will be the primary source for studying (in combination with the textbook). Again, **take good lecture notes**.

3. After a lecture, apply the **1-to-2 Rule**: For every 1 hour of lecture time you need to spend 2 hours of reading, re-writing, and studying the lecture material. Re-writing the course lectures is a good habit to practice weekly. As you re-write your notes, stop and think about important concepts and **redo the examples and rewrite the proofs of theorems covered in class at your own pace**. If you still have questions, ask them after class or come and see me during my office hours.

Homework Assignments and Homework Policy

Be prepared to spend a lot of time on your homework assignments. **Do not attempt a homework assignment before you apply the 1-to-2 Rule (see Study Tips above)**. Attempting an assignment before applying the 1-to-2 Rule is similar to walking in a dark room full of furniture. You will make many mistakes and it will take you twice as long to complete an assignment (maybe longer), and worse, your understanding of the concepts will be very shallow because you will learn how to solve specific problems only and you will not be learning the general concepts. Below I have summarized basic principles that you should follow when writing your homework assignment:

- **Organization** is key; write your solution in a logical and sequential manner. It is a good habit to first write what you are assuming and what you need to show. Then logically move from one idea to the next. If your work becomes difficult to follow then refine your writing until your proof flows naturally from step-to-step.
- **You cannot submit rough work** (e.g., crossed-out incorrect solutions/proofs). Your first draft should never be your final draft. Get in the habit of writing a rough draft and then write you final work once you are satisfied with your writing.
- **Justify any claims that are not perfectly clear**; you need to write out in full detail any major/important step that allows you to go from one idea to another.
- **Identify** the assignment: Homework #3, MATH XYZ, Section A, Name, Date, Instructor
- Use **proper mathematical notation** but do not use mathematical notation where you should be using words. For example, do use $\forall$ when you should be writing "for all". To save time and space, I will occasionally use math symbols in the place of words but your assignments should not contains these shorthand notations.
- Be **sensitive** to your readers. Write with a dark pencil or use a pen, avoid writing too big and avoid writing too small.
- **Staple your work.** Folded edges, paper clips, strings, and/or glue are not acceptable. **Unstapled work will not be graded and cannot be resubmitted**. Invest in a small stapler ($3.99) and keep it in your back-pack wherever you go.
- **Homework assignments that are judged by the Instructor to be unacceptable will be returned without being graded and cannot be resubmitted.**
- Homework assignments are due in class on the due date. **Late assignments will not be accepted.**
- Read the University's Academic Dishonesty Policy. I encourage you to collaborate with your colleagues on your homework assignments but your final written work should be your own

Numerical Software

You will need to install the latest version of Python. The software may be downloaded from

https://www.continuum.io/downloads

Python is a general purpose programming language, like C or Java. However, we will be using specific libraries (or modules) developed for scientific computations. These libraries are called SciPy and NumPy. Follow the link below for a tutorial on using both of these libraries:

https://docs.scipy.org/doc/numpy-dev/user/quickstart.html

Office Hours and Math Learning Center

I encourage you to come to my office (South Hall 325A) whenever you are having trouble with any part of the course material, seeking academic advice, or you just want to chat about mathematics in general. If you want to meet with me outside of my office hours, you will need to make an appointment, preferably via email. I also encourage you to visit the Math Learning Center located in South Hall 332 where you can receive free tutoring on a walk-in basis by highly qualified upper level students.

Academic Dishonesty and Plagiarism

Here is the definition of plagiarism and its consequences as described in SUNY Geneseo's Academic Dishonesty and Plagiarism statement:

"Plagiarism is the representation of someone else's words or ideas as one's own, or the arrangement of someone else's material(s) as one's own. Such misrepresentation may be sufficient grounds for a student's receiving a grade of E for the paper or presentation involved or may result in an E being assigned as the final grade for the course."

I expect that students will have read, and will follow, Geneseo's Academic Dishonesty and Plagiarism policy, which may be found at:

https://www.geneseo.edu/dean_office/dishonesty

Academic Accommodations

SUNY Geneseo will make reasonable accommodations for persons with documented physical, emotional, or cognitive disabilities. Accommodations will be made for medical conditions related to pregnancy or parenting. Students should contact Dr. Tabitha Buggie-Hunt in the Office of Disability Services (tbuggieh@geneseo.edu or 585-245-5112) and their faculty to discuss needed accommodations as early as possible in the semester.