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**MATH 8020: Graph Theory**

**Spring Semester 2024**

**Instructor – Joe DeMaio**

**CATALOG COURSE DESCRIPTION**

Prerequisite: Admission to the program or the department.

This course introduces standard graph theoretic terminology, theorems and algorithms necessary to the study of large data networks. Topics include graphs, trees, paths, cycles, isomorphisms, routing problems, independence, domination, centrality, and coloring problems. Data structures for representing large graphs and corresponding algorithms for searching and optimization purposes accompany these topics.

**Expected Learning Outcomes**:

1. Students will be able to use graph theoretic vocabulary and notation appropriately in both written and oral form.
2. Students will be able to represent graphs in multiple formats.
3. Students will demonstrate an understanding of the foundation of graph theoretic definitions and examples.
4. Students will rigorously differentiate between isomorphic and non- isomorphic graphs.
5. Students will demonstrate an understanding of connectivity of a graph.
6. Students will demonstrate an understanding of domination and independence in graphs.
7. Students will demonstrate an understanding of the graph coloring problem.
8. Students will demonstrate an understanding of trees and spanning trees in graph theory.
9. Students will demonstrate an understanding of optimization of objects in graph theory.
10. Students will be able to apply graph theoretic concepts to real-life scenarios.
11. Students will be able to use graph theoretic procedures in software packages. These include but are not limited to SAS or R, among others.

## Instructor Information and Policies for this course

**Professor:** Dr. Joe DeMaio
**Office:** Atrium 349
**In-office Office Hours at J 349:** MW 2:50-3:50
**Phone:** (470) 578-6568
**e-mail:** Do not email me through D2L (reply function does not work). Send email to me directly atjdemaio@kennesaw.edu
**Web Page: http://facultyweb.kennesaw.edu/jdemaio/**

**Coding:** Ability to use SAS or R is expected for projects

**Textbook and Online Resource Requirements***:*

Our resources are based on the texts,

*Graph Theory and its Applications*, 3rd edition, Gross, Yellen, and Anderson and *A Tour through Graph Theory*, 1st Edition, Saoub. The PROC OPTGRAPH manual can be found at <https://support.sas.com/documentation/cdl/en/procgralg/68145/PDF/default/procgralg.pdf>

**Grading**

There will be two tests and a final exam. Everything is worth 25%. Letter grades will be assessed on a 10-point scale. However, tests will have more than 100 possible points available so extra points are available to be earned. Cheating may result in the grade of an 'F' for the course! I do not report grades to students over the phone or through e-mail. I will not give your test to a friend. You must come to class or my office to pick up a test if you are not in class when I return them.

**I do not drop nor do I replace any grades!
I do not give make-up tests (unless there is a good reason and you must contact me prior to 48 hours after the test)!
There are no extra credit projects!
I do not make deals at the end of the semester for grades!**

**Homework**

There will be homework problems for each section covered. This homework will not be taken up and graded. It is to give you a point of reference from which to work. Test problems are often slight variations of homework problems if not the exact problem. The only way to succeed in this class is by doing all of the assigned homework! Merely, attending class will not be enough. A student will encounter a large number of techniques and examples in this course. It is vital to know and understand these new concepts. Successive lectures will assume the knowledge of previously stated techniques and examples. One must keep up with this material on a day-to-day basis! Because homework problems are not graded, you are allowed and strongly encouraged to work together on homework problems. I believe that it is very beneficial to regularly work problems in small groups of two to four people. This will decrease your chances of getting stuck on a problem and give you someone, other than your instructor, with whom to discuss homework problems. Obviously however, you must also be able to work problems without guidance for testing situations and when presenting at the board.

**Homework is mandatory (if you want a good grade) despite the fact that there is no homework grade!

Attendance**Every mathematics class is a building process from day one (actually, even from grade one). A student who misses classes has seriously compromised his or her knowledge of the material and will begin to feel an effect on their final grade. Attendance and class participation are important elements to incorporate into your study habits. I will distribute a sign-in sheet to document attendance at the beginning of each class. During the summer term I may, from time to time, distribute a second sign-in sheet after the break. Signing for another student will be treated as an honor code violation.

A student who misses a class is responsible for all material missed. Due to time constraints your instructor cannot re-present the lecture in a one-on-one setting. If circumstances dictate that a student will miss numerous class meetings, perhaps now is not the semester to take this course.

You are permitted 3 unexcused absences from this course. After those three, one loses 3 points for every additional unexcused absence from your final course average. Excused absences include health reasons as documented by a physician and conference attendance related to your Data Science program, among others. Sponsored lab meetings are not excused. If you are double-booked for such meetings let me know ASAP.

**Students with poor attendance will be reminded of such during discussions of their grade or special requests.

Graph Theory Project**Each student will complete a project that utilizes graph theory and PROC OPTGRAPH, R or some other graph theoretic software/package in a significant way. You may work in pairs. Should there be an odd number of students we can negotiate on a project group of size three or one. Each group will present their project in poster format at Analytics Day, C day **and** the KSU Symposium of Student Scholars. Each group member is equally responsible regarding the project. Should it appear to me that a group member is not carrying their weight, I reserve the right to assign different grades to different group members. Each project should be original and be the foundation of a talk/paper of interest to the Data Science community. This project represents 20% of your grade. Ideally, projects transform themselves into papers for publication. During class presentations of project work when I or other students give suggestions (that I verbally agree with) regarding “how to improve your project”, you should interpret as “how to improve your project grade.”

**Important Dates** Test 1: Feb. 7
Project ideas due: Feb. 21
Test 2: March 6
Poster draft due to DeMaio; in class poster presentations: March 20
Analytics Day posters turned in for judging April 9 5PM
Symposium of Student Scholars: April 17
Analytics Day: April 19
C Day: April 25
Final Exam: May 6, 1PM-3PM