



GOSHEN COLLEGE
MATHEMATICS DEPARTMENT
MATH 355 GRAPH THEORY – SPRING 2021

**Catalog
Description**

An introduction to the concepts and techniques of graph theory with application to diverse areas such as management, computers, circuitry, communications, and social networks. Topics covered include graphs and digraphs, paths and circuits, graph and digraph algorithms, trees, cliques, planarity, duality and colorability. Although expected to do both, students will have some opportunity to emphasize writing code or writing proofs. Prerequisite: A grade of C or higher in Math 211 and either Math 205 or Math 212. (3 credit hours)

**Learning
Objectives**

The student will

1. State and use definitions and theorems related to graphs, algorithmic complexity, and data structures to solve problems;
2. Explore examples, make conjectures, and write code and proofs;
3. Learn mathematics by reading, listening, exploring, and conversing in an effective manner;
4. Explain mathematical reasoning through writing in a precise and articulate manner in both informal and formal settings; and
5. Exhibit curiosity, playfulness, creativity, confidence, perseverance, interest in multiple perspectives, and a collaborative spirit.

Activities

The study of mathematics is not a spectator sport! Reading, listening, solving problems, writing explanations, reflecting upon ideas, and receiving feedback are essential to learning mathematics. Read with paper and pencil in hand, and take an anticipatory approach: try to obtain solutions, explanations, and proofs before reading what the author provides. Write down specific questions when you do not understand a portion of the text or a lecture. Try to recreate the key ideas, solve problems, and write proofs without looking at the book or notes.

Moodle will announce what should be read and done in preparation for class. Class time will be devoted to activities intended to deepen and extend your understanding. The homework assignment should solidify your knowledge and strengthen your ability to apply that knowledge. In the lab, you will work on a variety of mini-projects involving investigation, collaboration, and report writing. A midterm exam and a cumulative final exam will evaluate your understanding of and ability to use graph theory definitions, theorems, data structures, and algorithms.

An average student can obtain an average grade with an average of nine hours each week devoted to this 3-credit hour course (including class time)—adjust if you are not average or desire a grade that is not average.

Instructor

David Housman, SC 117, dhousman@goshen.edu, 535-7405
Office hours posted on office door and Moodle

Class Time

MWF 9:00-9:50 p.m. in SC 107.

Textbook

Algorithmic Graph Theory by Alan Gibbons, Cambridge University Press, ISBN: 0-521-28881-9. We will cover most of this concisely written book.

On-line

Moodle <https://moodle.goshen.edu> contains all course information. Announcements posted to the forum will be emailed to all students. When necessary, David's Zoom Link will be used for remote students during class and office hours.

Software

Sage (sagemath.org) and its collaborative notebook interface CoCalc (cocalc.com) will be used for computation. Free basic private server access will be provided.

Notebook	A three-ring binder with loose-leaf lined and graph paper is recommended so that you can keep a written record of problem-solving attempts, questions, math discoveries, and skill assessments.
Grading	Course grades will be based on class participation (10%), assignments (60%), a midterm exam (10%), and a comprehensive final exam (20%). If helpful, the final exam grade will replace the class participation or midterm exam score.
Class Participation	Come to class prepared, be attentive and respectful, engage in activities, offer ideas, ask relevant questions, and suggest possible answers.
Assignments	<p>Achieve and exhibit understanding by completing the assigned exercises. Your solutions will be evaluated on the correctness of your mathematical descriptions and arguments, the clarity of your writing, and the quality of your presentation.</p> <p>Assignments are typically due during the class after the class during which the corresponding topic was discussed. Individual exercise solutions can be resubmitted or submitted late by the class period after the first submissions are graded and returned to students, but a 30% penalty will be assessed on these resubmissions and late submissions. When resubmitting work, include the originally graded work. Students will often have a choice of exercises to complete in order to emphasize proofs or algorithms.</p> <p>You are encouraged to collaborate and seek assistance when having difficulties. You will have achieved the expected level of understanding when you are able to obtain your own solutions, independently reproduce solutions developed in collaboration or with assistance, and/or explain a solution to others.</p>
Exams	Exhibit your mastery of the learning objectives without assistance or collaboration. There may be both in-class and take-home portions for each exam.
Extra Credit	Receive extra credit toward your assignment grade by doing one or more of the following: (1) find errors in the text or posted course materials and describe the error in a post to the Questions and Answers forum; (2) attend a quantitative presentation (e.g., Science Speakers) or participate in a quantitatively based activity and describe in writing some interesting mathematical aspect of the presentation or activity; or (3) participate in a Career Services event and describe your most important discovery. The description should be a substantive paragraph or two and be submitted to the instructor on paper.
Tutoring	The Academic Success Center provides tutoring and writing support for free to all undergraduate students. Make an appointment at tutorcal.goshen.edu . Unfortunately, only one current student has previously taken this course. Your best bet to receive assistance is to make use of David's office hours.
Disability Services	Goshen College is committed to providing all students equal access to programs and facilities. Students who need accommodations based on disability should contact the Director of the Academic Success Center (ASC). Students must register with ASC before faculty are required to provide reasonable accommodations. For more information or to register, please contact the Director of the ASC, Judy Weaver, Good Library 112, jweaver@goshen.edu or 574-535-7560. To ensure that learning needs are met, contact the director of the ASC the first week of classes.
Collaboration and Academic Integrity	<p>You are encouraged to use all available resources in order to learn the concepts and techniques discussed in this course. In particular, conversations with other students and the instructor can be an effective learning method. Reading other books and web pages can be another effective learning method. However, copying someone else's work subverts the learning process.</p> <p>For assignments, you may look at and discuss another student's work, but any written work developed during collaboration with another student should be destroyed before writing your own solutions. You should give written acknowledgement to people with whom you have had discussions and to any written materials (other than the text) that were helpful.</p> <p>For exams, you may <i>not</i> use any resources unless a specific exception is stated by the instructor.</p> <p>Failure to observe the above rules will result in a zero on the assignment or exam. Any violation of academic integrity will be reported to the Academic Dean. Observation of the above rules will help you learn the material well and give you the satisfaction of knowing that you have earned your grade.</p>

Due Date Policy Class participation, assignments, and exams can only be excused, rescheduled, or made up if (1) there is a serious medical problem, a death in the immediate family, or an irreconcilable conflict with another official Goshen College activity; (2) there is written documentation signed by proper authorities; and (3) the instructor is notified prior to the due date or as soon as possible afterwards.

Course Materials are for Private Use Course materials (videos, assignments, exams, problem sets, etc) are for use in this course only. You may not upload them to external sites, share with any person outside this course, or post for public commentary without written permission from the professor. Sharing recordings outside of the class could lead to a copyright or FERPA violation. Goshen College prohibits any student from duplicating, downloading, or distributing class recordings with anyone outside of this class, for any reason.