

MATH 4022 Syllabus

Introduction to Graph Theory, Sections BU and BG, 3 credit hours

Fall 2026

Class meetings: Mondays and Wednesdays, 8:00–9:15 a.m., in Skiles 368.

Instructor Information

Instructor: Tom Kelly

Email: tom.kelly@gatech.edu

Office hours: Mondays, 12:30–1:30 p.m., and Wednesdays, 11:00 a.m.–12:00 p.m.

General Course Information

Description

A *graph* is an abstract representation of a structure with pairwise relations. Graphs can be used to model things like the internet, social networks, and traffic networks, to name only a few. Moreover, graph theory has numerous applications in pure mathematics. This course will cover the fundamentals in graph theory, including but not limited to trees, matchings, connectivity, planarity, and coloring.

Course Learning Outcomes

Upon successful completion of this course, you should be able to:

- explain and apply fundamental graph-theoretic concepts and theorems;
- distinguish different methodological approaches in graph theory, including classification, extremality, optimization and sharpness, algorithms, and duality;
- construct and communicate rigorous mathematical proofs in core areas of graph theory, both in discussion and in writing.

Required Course Materials

The textbook for this course is *Introduction to Graph Theory* (2nd ed., 2001) by Douglas B. West, ISBN 0-13-014400-2.

Grading Policy

This course uses *standards-based grading*. This means that your work is evaluated separately against clearly stated learning targets rather than by adding points from unrelated questions and averaging them into a percentage. Your final letter grade is determined by the number and range of learning targets that you demonstrate, the quality of that evidence, your performance on the final assessment, and your attendance.

Every graded question in the course is evaluated using an EMRN rubric. Each question has a problem-specific rubric, but the four ratings always have the following meanings:

Exemplary (E). The response is correct, complete, precise, and especially clear. All essential evidence is present, and the reasoning is well organized.

Meets expectations (M). The response demonstrates the learning target with a correct strategy, adequate justification, and no substantive mathematical errors. Minor slips or presentation issues may remain.

Revision needed (R). The response shows meaningful progress and some correct reasoning, but a substantive error, omission, or justification gap prevents it from demonstrating the learning target.

Not yet assessable (N). The response provides too little relevant evidence to assess the learning target, or its approach is based on a fundamental misunderstanding.

The course is organized into five modules: Graph Basics, Matchings, Connectivity, Planarity, and Coloring. Module 1, Graph Basics, provides the terminology, methods, and proof foundations used throughout the course but is not assessed directly. Each of Modules 2–5 has four assessed learning targets, for a total of sixteen, and each of these four modules has its own dedicated assessment. There are also two scheduled reassessment days on which you may revisit selected targets. The final assessment provides another opportunity to improve your ratings on selected targets, but it also serves as an independent check of retention: to earn an A, B, C, or D, you must earn E or M on at least eight, seven, six, or four of the nine targets you select on the final, respectively. The separate *MATH 4022 Learning Targets and Study Guide*, available through Canvas, states all sixteen targets and provides detailed lesson-level objectives and textbook readings. It will also provide representative problems, sample EMRN rubrics, and complete solutions.

The table below summarizes when each module’s targets may be assessed. Short vertical dividers group the modules available for each assessment opportunity.

Modules	Module 1	Module 2	Module 3	Module 4	Module 5
	Graph Basics	Matchings	Connectivity	Planarity	Coloring
	<i>not assessed</i>	<i>4 targets</i>	<i>4 targets</i>	<i>4 targets</i>	<i>4 targets</i>
Initial assessments	—	Wed., Sept. 23	Wed., Oct. 14	Wed., Nov. 4	Mon., Nov. 23
Reassessments	—	Mon., Oct. 26 choose 4 targets		Wed., Dec. 2 choose 4 targets	
Final assessment	—	Friday, December 11, 8:00–10:50 a.m. choose 9 targets			

A learning target is *certified* when you earn either E or M on a question assessing that target. An R or N does not certify the target. Your highest rating on each target is retained: later work can improve an earlier rating, and a later lower rating does not erase stronger evidence you have already provided. You may use reassessment opportunities to certify a target that is not yet certified or to improve an M to an E. On each reassessment, you may select up to four eligible targets; on the final assessment, you may select up to nine targets. Only the responses corresponding to your selections will be graded.

The table below gives the minimum requirements for each letter grade. You earn the highest grade for which you satisfy *every* requirement in the corresponding row. A target certified on the final assessment counts both toward your cumulative total and toward the final-assessment requirement. Likewise, an E earned on the final counts toward the A-level E requirement. Target 4 in each assessed module is the module’s proof-writing target.

Grade	Certified targets	E ratings	Certified proof targets	Each assessed module	Final exam E/M ratings	Attendance
A	15 of 16	at least 7	3 of 4	at least 2	8 of 9	at least 85%
B	13 of 16	no min	2 of 4	at least 2	7 of 9	at least 65%
C	11 of 16	no min	1 of 4	at least 2	6 of 9	at least 50%
D	8 of 16	no min	0 of 4	at least 1	4 of 9	no min

Attendance will be recorded only on the eighteen instructional days after the first two weeks of class. It will not be recorded during the first two weeks, on module assessment days, or on reassessment days. Assessment days do not count toward your attendance percentage, although you remain responsible for completing the scheduled assessments. Attendance at reassessment days is not required.

Your attendance percentage is the number of these eighteen instructional days that you attend, divided by eighteen. Thus, the A, B, and C attendance cutoffs in the table correspond to attending at least 16, 12, and 9 of these days, respectively. There is no minimum attendance requirement for a D.

Description of Graded Components

The module assessments, reassessments, and final assessment are in class and closed book and notes.

Course Calendar

This tentative calendar lists every scheduled Monday and Wednesday class meeting and every Institute holiday or recess that affects the course. Any changes will be announced in class and through Canvas. The dates are based on the official Fall 2026 academic calendar.

The instructor will be away at a conference during Thanksgiving week, November 23–27. The Module 5 Coloring assessment on Monday, November 23, remains scheduled. Substitute or alternative arrangements for that meeting will be announced in advance.

There are 28 scheduled class meetings. Four days are devoted to assessing Modules 2–5, two days are devoted to reassessment, and two post-Thanksgiving meetings are devoted to review. The remaining days are divided equally among Modules 1–5, with four days of instruction in each module.

Date	Activity or Institute event
Mon., Aug. 24	Module 1: Graph basics (1 of 4).
Wed., Aug. 26	Module 1: Graph basics (2 of 4).
Mon., Aug. 31	Module 1: Graph basics (3 of 4).
Wed., Sept. 2	Module 1: Graph basics (4 of 4).
Mon., Sept. 7	No class: Labor Day (Institute holiday).
Wed., Sept. 9	Module 2: Matchings (1 of 4).
Mon., Sept. 14	Module 2: Matchings (2 of 4).
Wed., Sept. 16	Module 2: Matchings (3 of 4).
Mon., Sept. 21	Module 2: Matchings (4 of 4).
Wed., Sept. 23	Module 2 assessment: Matchings.
Mon., Sept. 28	Module 3: Connectivity (1 of 4).
Wed., Sept. 30	Module 3: Connectivity (2 of 4).
Mon., Oct. 5	No class: Fall Break.
Wed., Oct. 7	Module 3: Connectivity (3 of 4).
Mon., Oct. 12	Module 3: Connectivity (4 of 4).
Wed., Oct. 14	Module 3 assessment: Connectivity.
Mon., Oct. 19	Module 4: Planarity (1 of 4).
Wed., Oct. 21	Module 4: Planarity (2 of 4).
Mon., Oct. 26	Reassessment 1: up to four eligible Matchings and Connectivity targets.
Wed., Oct. 28	Module 4: Planarity (3 of 4).
Sat., Oct. 31	Withdrawal deadline.
Mon., Nov. 2	Module 4: Planarity (4 of 4).
Wed., Nov. 4	Module 4 assessment: Planarity.
Mon., Nov. 9	Module 5: Coloring (1 of 4).
Wed., Nov. 11	Module 5: Coloring (2 of 4).
Mon., Nov. 16	Module 5: Coloring (3 of 4).
Wed., Nov. 18	Module 5: Coloring (4 of 4).
Mon., Nov. 23	Module 5 assessment: Coloring; instructor away.
Wed., Nov. 25	No class: student recess; campus open.
Nov. 26–27	Thanksgiving Break.
Mon., Nov. 30	Comprehensive reassessment review, including feedback from the Coloring assessment.
Wed., Dec. 2	Reassessment 2: up to four eligible Planarity and Coloring targets.
Mon., Dec. 7	Final-assessment review, including reassessment feedback when available.
Wed., Dec. 9	No class: reading period.
Fri., Dec. 11	Final assessment, 8:00–10:50 a.m.

Course Policies

Attendance and Participation

Attendance will be recorded only on the eighteen instructional days after the first two weeks of class, including the two review meetings. It will not be recorded during the first two weeks, on module assessment days, or on reassessment days. Attendance at reassessment days is not required.

The A-level cutoff for attendance permits up to two unexcused absences. Students with fewer than four total absences will also qualify for an A, as it will be assumed in good faith that at least two of those absences could have been excused.

Excused absences during one of the eighteen instructional days after the first two weeks of class will count towards the total number of classes attended; in order for an absence to be considered excused, you must notify the instructor within one week of the missed class period and provide appropriate documentation.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.