MATH 349: Discrete Mathematics
Fall 2017

"There's a party game where each of the players has to talk for one minute without repeating themselves. It's hard; change the minute to an hour and it's impossible. The theorems of this section will make the point mathematically. If you have a large structure built out of a small range of materials, the structure has to contain many repetitions."
— W. Hodges, 1993

Instructor: Wesley Calvert
Office: Neckers A 357
Office Hours: Official (guaranteed) hours, Wednesday and Friday 8-9 and 3:00-4:30; Thursday 12-1; also make an appointment or come see me.
Web Page: `http://lagrange.math.siu.edu/calvert/teaching/349f17/`

Office Phone: 453-6582
Home Phone: 985-3429
Cell Phone: 534-8457
e-mail: `wcalvert@siu.edu`

Course Goals

After years of instruction in liner and polynomial algebra, calculus, and the like, it is easy to get the idea that the power of mathematics lives only in, and applies only to, the world of continuous functions of a real variable. That is simply not true.

The principal goal of this class is to enable you to apply the power of mathematical abstraction and rigor to contexts where the primary objects are finite or countably infinite structures.

A secondary goal is that you will improve your general mathematical skills: making sense of problems and persevering in solving them, reasoning abstractly and quantitatively, constructing viable arguments and critiquing the reasoning of others, modeling with mathematics, using appropriate tools strategically, attending to precision, looking for and making use of structure, and looking for and expressing regularity in repeated reasoning.

Course Content

After a very quick review of foundational aspects of mathematical reasoning (you likely saw all of these points in MATH 302, but have probably seen most elsewhere, as well), we begin the course in earnest with systems of counting and classification. You have likely seen some (like permutations — although perhaps not at the same depth), but others (Euler's function, sieves, and designs) will likely be new to you.

Algorithms are central to modern mathematics; many of the professional mathematicians I know in industry are in areas of discrete mathematics, designing software to solve problems. We will look at verification and efficiency of algorithms, as well as algorithms to solve particular problems.

Many of the most exciting developments in the last twenty years in mathematics — especially applied mathematics — involve understanding graphs and networks. We will devote considerable attention to these structures.

Some methods for handling discrete structures arise from algebra — from the study of quintic formulas and the like. Considerations like this will give us solutions to several interesting problems, including the use of error-correcting codes.

Course Activities

Homework will be assigned frequently, and will be due each week on Fridays (unless otherwise announced). The most common thing in all of mathematics — I do it myself, as does every other mathematician I know — is to see somebody else doing a problem and say, "Yes, yes, of course. I understand completely," and then walk away and realize that we had no idea at all what was going on. Homework is your guard against this. If you really understand how to do the homework, you're generally in pretty good shape. If you can't, you've got plenty of time to figure it out, ask me, ask a friend, or take whatever other action you see fit.

Homework will always be due at 4:30 on the appointed day. You are, of course, welcome to turn it in when you come to class. If you wish, though, you may continue to work on it, and may deliver it to my office or my department mailbox.

Cooperation on homework and labs is strongly encouraged. There will almost certainly be problems on which it is necessary. Talk with each other, talk with me, talk with friends, use any resource. It is important, however, to be

sure that you understand the solution you present. In designing the tests, I will assume thorough familiarity with all homework problems due before the date of the exam.

You are also encouraged to visit me in my office (see note on office hours above) or to call or e-mail me. To be more clear: It's a hard class. I'd like to see you do well in it. I'd love to talk with you and to help you in any way that I can.

The homework will often be hard. You will seldom be able to solve all of the problems in one setting. Plan your time accordingly.

The class will meet on Monday, Wednesday, and Friday at 2:00. A typical meeting will begin with a discussion of any questions folks have, with procedural matters treated first. This will be followed by a discussion of new material (often in the form of problems, on which students will work in groups) and typically an assignment of new homework.

You should be in every class meeting, and should make sure that you are actively engaged. It goes without saying that when a problem is assigned for group work, you must do it. If you wait for me to tell you how to do it, then by the time I talk about the solution with the class, everybody else will understand it and will be ready to ask about issues you haven't encountered, and you will be lost. Don't do this. You should be careful to ask any questions you have. You should also feel free to be wrong. We all will be at some point in the class. That's why we gather together, instead of just reading the book on our own: we can help one another understand better, and we can try out ideas on each other, even if we aren't quite sure of them.

Text: Norman L. Biggs, *Discrete Mathematics*, 2nd edition, Oxford University Press, 2003

Be warned. The bookstores have been known to offer some other books as "recommended" for math courses. They are recommended by the bookstore, not by the math department, and not by me. I don't particularly recommend against them (since I have little idea what they'll be), but let the buyer be ware.

The text makes a great effort — and a successful one at most points — to be readable. It will provide an important opportunity to get an explanation in a different voice (at times very different) than that of your beloved teacher.

There will also be some exams. Each exam will be preceded by a review sheet indicating *exactly* what material will be covered, an in-class review session, and an out-of-class review session. An exam will be given in the regularly scheduled class time and place on 10/13. In addition, there will be a final exam on Friday, December 15, from 12:30 to 2:30. The final will test your ability to do all of the things we have worked on in class, with particular emphsis on material covered since the mid-term exam.

Each student will complete a significant research project over the course of the term, and will give a presentation on the results on December 1, 4, or 6. More information will be forthcoming.

The general philosophy is that class sessions and homework will be very hard and tests will be pretty easy (assuming, of course, that you've suffered through the class meetings and homework leading up to them). Again, my goal with the homework is to help you to understand the material so well that you're unhappy with me for giving such a boring (easy) test.

In all activities for this class, make sure that you *do something*. It is depressing how often students who probably know something relevant to a problem do absolutely nothing, allowing no opportunity to receive credit on the part they actually know.

Grading

Grades will be calculated from the following sources:

Homework	200
In-class exam	100
Project	200
Final Exam	100
	600 pts

Failure to attend class regularly will certainly adversely affect your grades on each of these factors. For instance, while I do not artificially lower grades for bad attendance, it has consistently held that almost all grades below C- that have been achieved in classes that I have taught have been associated with significant attendance problems.

In like manner, you should not underestimate the impact of your homework. Not only does the experience of the homework problems impact your test grades, but the homework itself is a considerable portion of the grade in the class. *When you submit a correct solution to a problem, you will get full credit for that problem. Thus, everyone should receive a grade of 100% on the homework.* No credit will be given for a problem whose correct solution is never submitted.

In all work done for this class, work is more important than answers. A correct answer without correct work (or worse, with work that does not match the answer) is not worth much at all, while generally correct work with an incorrect answer is almost as good as being completely right. Thus, getting the right answer does not guarantee a good grade on the problem, and getting a wrong answer does not guarantee a bad one.

I will make the following guarantees about letter grades. I may decide to lower these criteria (i.e. give a higher grade than the one shown here, if I see that the questions were hard enough that lower numbers more accurately reflect my true standards), but will never raise them.

Percent of total	Grade
90–100	A
80–89	B
70–79	C
60–69	D
≤ 59	E

Prerequisites

The prerequisites of this course are designed to save you from spending a semester being miserable and failing this course. *I am on your side, and wish you success. That is why I am telling you this.* To take this course, you must have completed MATH 221 and 250, and have either completed MATH 302 or be concurrently enrolled in 302.

Any student not meeting these requirements is *strongly* advised to delay taking this class until they are satisfied.

Catalog Description

Numbers, sets, relations and functions; elementary enumeration; introduction to graph theory; logic, partially ordered sets and Boolean algebra; mathematical induction; recurrence relations.

Syllabus Attachment

Fall 2017

MISSION STATEMENT FOR SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

SIU embraces a unique tradition of access and opportunity, inclusive excellence, innovation in research and creativity, and outstanding teaching focused on nurturing student success. As a nationally ranked public research university and regional economic catalyst, we create and exchange knowledge to shape future leaders, improve our communities, and transform lives.

IMPORTANT DATES *

Semester Classes Begin:…..……..…….**08/22/2017**
Last day to add full-term course (without Dean's signature): ..…..**08/27/2017**
Last day to withdraw from the University with a full refund:…….**09/01/2017**
Last day to drop a full-term course for a credit/refund:……...**09/03/2017**
Last day to drop a full-term course (W grade, no refund):……..**10/29/2017**
Final examinations: ……**12/11–12/15/2017**

Note: Please verify the above dates with the Registrar calendar and find more detailed information on deadlines at http://registrar.siu.edu/calendars. For add/drop dates that apply to shorter-than-full-term courses, please look at the Schedule of Classes search results at http://registrar.siu.edu/schedclass/index.php

SUMMER SEMESTER HOLIDAYS

Labor Day Holiday 09/04/2017
Fall Break 10/07—10/10/2017
Thanksgiving Break 11/22—11/26/2017

WITHDRAWAL POLICY ~ *Undergraduate only*

Students who officially register for a session must officially withdraw from that registration in a timely manner to avoid being charged as well as receiving a failing grade for those classes. An official withdrawal must be initiated by the student, or on behalf of the student through the academic unit, and be processed by the Registrar's office. For the proper procedures to follow when dropping courses and when withdrawing from SIU visit: http://registrar.siu.edu/students/withdrawal.php

INCOMPLETE POLICY~ *Undergraduate only*

An INC grade may be assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments for the course. An INC must be changed to a completed grade within one full semester (undergraduates), and one full year (graduate students), from the close of the term in which the course was taken or graduation, whichever occurs first. Should the student fail to complete the remaining course requirements within the time period designated, the incomplete will be converted to a grade of F and such grade will be computed in the student's grade point average. *For more information visit:* http://registrar.siu.edu/grades/incomplete.php

REPEAT POLICY

An undergraduate student may, for the purpose of raising a grade, enroll in a course for credit more than once. For students receiving a letter grade of A, B, C, D, or F, the course repetition must occur at Southern Illinois University Carbondale. Effective for courses taken Summer 2013 or later, only the most recent (last) grade will be calculated in the overall GPA and count toward hours earned.
This policy will be applied to all transferrable credit in that only the last grade will be used to calculate grade point average. Only those courses taken at the same institution are considered repeats under this policy. *See full policy at* http://registrar.siu.edu/students/repeatclasses.php

GRADUATE POLICIES

Graduate policies often vary from Undergraduate policies. To view the applicable policies for graduate students, please refer to the graduate catalog at http://gradschool.siu.edu/about-us/grad-catalog/

DISABILITY POLICY

Disability Support Services provides the required academic and programmatic support services to students with permanent and temporary disabilities. DSS provides centralized coordination and referral services. To utilize DSS services, students must contact DSS to open cases. The process involves interviews, reviews of student-supplied documentation, and completion of Disability Accommodation Agreements. http://disabilityservices.siu.edu/

PLAGIARISM

See the Student Conduct Code http://srr.siu.edu/student-conduct-code/

MORRIS LIBRARY HOURS: http://libguides.lib.siu.edu/hours

ADVISEMENT: http://advisement.siu.edu/

SAFETY AWARENESS FACTS AND EDUCATION

Title IX makes it clear that violence and harassment based on sex and gender is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here: http://safe.siu.edu

SALUKI CARES

The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in any type of distress—physical, emotional, financial, or personal. By working closely with faculty, staff, students and their families, SIU will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. For Information on Saluki Cares: call(618) 453-1492, email siucares@siu.edu, or http://salukicares.siu.edu/

SIU's EARLY WARNING INTERVENTION PROGRAM (EWIP)

Students enrolled in courses participating in SIU's Early Warning Intervention Program might be contacted by University staff during a semester. More information can be found at the Core Curriculum's Overview webpage: http://corecurriculum.siu.edu/program-overview/

EMERGENCY PROCEDURES

We ask that you become familiar with **Emergency Preparedness @ SIU.** Emergency response information is available on posters in buildings on campus, on the Emergency Preparedness @ SIU website, and though text and email alerts. *To register for alerts visit:* http://emergency.siu.edu/

STUDENT MULTICULTURAL RESOURCE CENTER

The Student Multicultural Resource Center serves as a catalyst for inclusion, diversity and innovation. As the Center continues its work, we are here to ensure that you think, grow and succeed. We encourage you to stop by the Center, located in Grinnell Commons, to see the resources available and discover ways you can get involved on the campus. *Visit us at* http://inclusiveexcellence.siu.edu/

LEARNING AND SUPPORT SERVICES

Help is within reach. Learning support services offers free tutoring on campus and math labs. To find more information please visit the Center for Learning and Support Services website:
Tutoring : http://tutoring.siu.edu/
Math Labs http://math.siu.edu/courses/course-help.php

WRITING CENTER

The Writing Center offers free tutoring services to all SIU students and faculty. To find a Center or Schedule an appointment please visit: http://write.siu.edu/

DIVERSITY

Southern Illinois University Carbondale's goal is to provide a welcoming campus where all of our students, faculty and staff can study and work in a respectful, positive environment free from racism and intimidation. *For more information visit*: http://diversity.siu.edu/#

MILITARY COMMUNITY

There are complexities of being a member of the military community and also a student, and military and veteran related developments can complicate academic life. If you are a member of the military community and in need of accommodations please visit Veterans Services at http://veterans.siu.edu/

SIU ONLINE: https://online.siu.edu/

Need help with an issue? Please visit SALUKI SOLUTION FINDER at http://solutionfinder.siu.edu/