Course Syllabus
MTH/CSC 447: Discrete Mathematical Structures, Spring 2018

Instructor: Bill Kinnersley

Office: Lippitt 101B
Office hours: Mon. 2-4 PM and Wed. 10-12 PM
Office phone: (401) 874-2989
Email: billk@uri.edu

Course Website: This course will use Sakai. The Sakai site will contain lecture notes, homework assignments, and administrative announcements. Check it often!

Course Content: Concepts and techniques in discrete mathematics. Proofs and mathematical induction, techniques of counting, recurrence relations, graphs.

Classroom Conduct: The classroom is a place for learning. While you are in class, I expect you to remain focused on the course material, and also to maintain an environment in which other students can do the same. In particular:

- Laptops and tablets can be useful for taking notes or for annotating electronic copies of the provided lecture notes. However, they can also be major distractions. Don't screw around on the internet during class! This is distracting not only to you, but also to other students sitting nearby. Use of laptops or tablets for any purpose other than note-taking will not be permitted.
- Cell phones should be muted and stored away at all times during class. Ringing phones are disruptive. Texting during class is flat-out disrespectful.
- All in-class discussion must pertain to the course material. Asking your neighbor about the roots to the characteristic equation of a linear recurrence relation is fine; asking them about Friday night's frat party is not. Off-topic chatter can be distracting to other students.

Textbook: The textbook for this course is *Discrete Mathematics and Its Applications*, by Kenneth H. Rosen. *It is not required.* However, you may find it useful as a reference, a supplement to the provided lecture notes, and a source of practice problems. The most recent edition is very expensive, but earlier editions are much cheaper and should still suffice for this course.

Evaluation: The course grade will be based on weekly quizzes, two midterm exams, and a final exam, weighted as follows:

- Homework: 30%
- Midterm exams: 20% each (40% total)
- Final exam: 30%

Scores will be posted in the Sakai gradebook.

The scale for letter grades will be:

<table>
<tr><td colspan="2">A: 93.00% and above</td><td>A-: 90.00% - 92.99%</td></tr>
<tr><td>B+: 87.00% - 89.99%</td><td>B: 83.00% - 86.99%</td><td>B-: 80.00% - 82.99%</td></tr>
<tr><td>C+: 77.00% - 79.99%</td><td>C: 73.00% - 76.99%</td><td>C-: 70.00% - 72.99%</td></tr>
<tr><td>D+: 67.00% - 69.99%</td><td colspan="2">D: 60.00% - 66.99%</td></tr>
<tr><td colspan="3">F: 59.99% and below</td></tr>
</table>

These cutoffs might be lowered slightly if deemed appropriate, but they will *not* be raised.

Homework: Homework will be assigned on most Thursdays (on Sakai) and will be collected on the following Thursday *at the beginning of class.* On each assignment, I will choose three or four questions to grade in detail; these will account for about half of the total credit on the assignment. The remaining questions will be checked for completion, but not for correctness. This means that you're guaranteed at least half of the homework points just for putting in the effort to complete the assignment.

As this is an upper-level mathematics course, it is imperative that your homework solutions be clear, logically sound, and mathematically precise. Being able to communicate your ideas clearly and effectively is an important (and often overlooked) aspect of mathematics!

You are welcome to work on the homework together with your fellow students, but you *must* write up your own solutions *in your own words.* Copying from another student's homework solutions will be considered plagiarism and will be dealt with *very harshly.*

Late Homework: Late homework assignments will be accepted up until the next class period after the original due date, at a penalty of 20 percentage points. This penalty may be waived under extenuating circumstances (at the instructor's discretion).

Midterm Exams: There will be two midterm exams, held in class on February 22 and April 5 (both of which are Thursdays).

Final Exam: The final exam will be held in the regular classroom on Thursday, May 3, from 3:00 PM - 6:00 PM. It will be cumulative.

Calculator Policy: No calculators! You may not use calculators on any of the exams, nor should you need to. (I will try to be very forgiving of any arithmetic mistakes.)

Regrading Policy: If you have any questions or concerns about the grading of an assignment, please contact me within one week of the day the assignment was returned to the class, and I'll take another look at it.

Absence Policy: If you miss any exam due to illness or emergency, you must contact me – in person, by phone, or through email – *within 24 hours*. Under most circumstances, absences must be documented.

If you know that you will need to miss an exam due to religious observances or University-sanctioned events, you must contact me at least *one week* in advance.

Academic Accommodations: If you require academic accommodations and have documentation from Disability Services (874-2098), please get in touch with me as soon as possible.

Academic Integrity: Cheating is prohibited in all aspects of the course. Cheating includes but is not limited to: copying from another student's homework solutions, copying homework solutions from an outside source (e.g. the internet), communication with other students during an exam, reading another student's written work during an exam, and use of any electronic device (including calculators) during an exam. You are free to collaborate with other students on homework assignments, but you must write up your own solutions, and your homework submission must include a list of all students you worked with. I take cheating very seriously; *any* cheating will result in severe consequences.

Other Comments: Please feel free to talk to me if you have any questions about the material. I'm here to help! Make use of my office hours. If you can't make it to my office hours, let me know and we can set up some other time to meet. Please also feel free to email me with questions (though this works best for short and simple questions; complex questions are usually better discussed in person).

Course Goals: The overall aim of Math 447 is to introduce students to the basic objects, tools, and techniques of discrete mathematics, as well as to enhance their problem-solving skills by showing them how to approach problems from a combinatorial perspective. The specific goals of Math 447 are:

- To provide an introduction to mathematical proof.
- To provide a thorough introduction to counting.
- To provide an introduction to recurrence relations and their applications.
- To provide an introduction to generating functions and their applications.
- To provide a thorough introduction to graph theory.

Math 447 Learning Outcomes: At the end of the course, the student should be able to:

1. **Mathematical proof:** Select an appropriate technique for proving a simple mathematical proposition; techniques covered include direct proof, proof by cases, proof by contradiction, combinatorial proof, and mathematical induction. Disprove a false universal statement by finding a counterexample.

2. **Counting:** Apply the multiplication principle and addition principle to solve counting problems, including being able to break a complex problem down into simpler steps to apply the multiplication principle. Be familiar with permutations, combinations, and multinomial coefficients, and be able to decide which of these is appropriate for a given problem. Solve counting problems by interpreting them as occupancy problems.

3. **Recurrence relations:** Use a recurrence relation to compute values of a recursively-defined sequence. Use mathematical induction to formally prove that a given formula is a solution to a given recurrence relation. Solve linear recurrence relations with constant coefficients (both homogeneous and non-homogeneous) by using the characteristic polynomial. Use recurrence relations to model simple counting problems.

4. **Generating functions:** Understand the connection between sequences and their generating functions. Convert a generating function from a power series into a closed form and vice-versa. Use generating functions to solve recurrence relations. Use generating functions to solve counting problems. The student will be exposed to both ordinary and exponential generating functions, but the focus is heavily on the former.

5. **Graph theory:** Model real-world problems using graphs, directed graphs, and multigraphs. Solve shortest-path graph problems using Dijkstra's algorithm. Compute minimum spanning trees using Kruskal's algorithm. Show that a graph is planar, or use Wagner's theorem to prove it nonplanar. Determine whether a graph is bipartite. Establish a lower bound on the chromatic number of a graph by constructing a proper coloring and, in simple cases, prove a matching upper bound. Find a maximum matching in a bipartite graph. Use graph colorings and matchings to model real-world problems.