Catalog description: An introduction to discrete mathematics. Topics covered include logic, sets, functions, relations, counting, mathematical induction, recurrence relations, and graphs. The topics are tied together through an emphasis on proof techniques and mathematical writing.

Prerequisite: Successful completion of Calculus I or equivalent HS background

Texts:

- *Book of Proof* by Richard Hammack, 2013 will be used extensively and almost in its entirety. And I expect you to read the text. A pdf is available at


  A print on demand copy is available through Amazon for less than $25.

- Other on-line resources will be listed on the D2L page as we get to the material.

Goals:

- Develop mathematical maturity to formulate and solve interesting mathematical problems. You will increase your problem-solving skills by struggling with new-to-you and rich mathematical problems.

- Develop higher-order habits of mind. You recognize and understand how to utilize many common mathematical patterns.

- Articulate the role of proof in mathematics.
  
  - You understand the role of definitions in mathematics and learn the definitions for the material covered.
  
  - You use standard logical arguments to justify mathematical statements.
  
  - You write clearly using standard mathematical notation.
  
  - You learn and begin to apply proof techniques including direct, contrapositive, proof by contradiction, and induction proofs.

Objectives:

Section objectives will be outlined on D2L as we work through the course. You can, and should, think of these outlines as your beginning of a study guide and reference for the course.
Expectations:

**In class:** Most class meetings will consist of some lecture and involve you in working through activities and examples exploring ideas and techniques. Please come to class prepared, willing and eager to work during class time, to collaborate with your peers and to ask questions of me. This preparation will not only help you to learn the material and perform well in the course, but it will also produce a much more enjoyable learning environment for all of us. Class attendance is expected since the in-class activities are valuable learning experiences. Needless to say, you are responsible for everything presented in class, the sections assigned for reading, and assignments.

**Outside-of-class:** Extensive work for this course, typically involving 8-12 hours per week will be divided among:

- reading sections in the text and other books
- reviewing, completing and correcting your class notes
- working on assignments
- preparing for exams

**NOTES:**

- Creating a good organization system for your notes from in class and taken while reading the texts, the handouts from class, and the section objectives is essential. Minimally, you’ll need a three ring loose-leaf binder; I provide handouts daily. You should expect to rewrite your notes filling in missed details after each class.
- You need to start your own dictionary of mathematical terms. Mathematical terms will be introduced in one class; **definitions are expected to be memorized by the next class.** Complete understanding of the term is expected by the second class after introduction of the term.
- **You will be held responsible for all of the information and announcements I post on D2L.**

**Integrity:** Central to the purpose and pursuit of any academic community is academic integrity. All members of the Westminster community, including students, faculty, staff, and administrators, are expected to maintain the highest standards of honesty and integrity, in keeping with the philosophy and mission of the College. Academic dishonesty is a profound violation of this code of behavior.

The paragraph above is taken from the Westminster College 2017-2018 Undergraduate Catalog, page 65. It is imperative that you never submit the work of others as though it is your own work nor should you ever allow anyone else to use your work without giving credit to you. The penalty for academic dishonesty in this class is minimally the grade of 0 on the assignment and, except for unusual circumstances, a grade of F for the course. Any event of academic dishonesty is reported to the Dean of the College. Other details of violations and consequences are given in the Catalog.

**Group work is expected.** Within the group work context, it is possible to misunderstand exactly what it means to be responsible for “doing your own work.” As
such, I wish to define specifically what I expect. Group study is a proper and effective way
to study if all of the participants have done their full share of the work. You may and
should discuss problems together and reach conclusions together. But it is a form of
dishonesty for a student who has not attended class, read the assignment, or thought
about the problem on his or her own to try to use the ideas developed by a group or claim
credit for work to which he or she has not contributed. It is also a form of dishonesty to
courage or allow such practices on the part of others.

Aside from integrity issues, writing solutions on your own allows you to determine how
much of the material you understand versus how much you can “do.” At some point you
are responsible for understanding each and every piece of the problems and will need to be
able to write the complete solutions in your own words.

**Accessibility:** Westminster College actively strives for the full inclusion of all our
students. Students with disabilities who require access solutions for environmental or
curricular barriers should contact Faith Craig, Director of Disability Resources, located in
414 Thompson Clark Hall.
Phone: 724-946-7192
e-mail: craigfa@westminster.edu

**Assessment:**

**Graded homework:** There will be weekly graded homework where you will hand
in carefully written solutions to selected problems. Your lowest homework grade will
be dropped, so late assignments will not be accepted. Discussion of the assignments
with anyone and everyone is encouraged, but all submitted work must be written
independently. In particular, you are not permitted to see the actual pages that
another student is submitting. Homework is due each Friday at the beginning of
class.

**Weekly Quizzes:** There will be weekly quizzes every Monday unless otherwise
announced. Each quiz will correspond roughly to a chapter in the *Book of Proof.*
You will be permitted to take a version of each quiz up to two times. The second
attempt will test other aspects of the same material. If you choose to take the quiz a
second time, the grade recorded will be an average of the two scores. Your lowest
(average, if makeups are chosen) quiz grade will be dropped. No makeup quizzes will
be given for either excused or unexcused absences, no exceptions.

**Exams:** Mid-term exams are tentatively scheduled for Sept. 21, Oct. 26, and Nov.
16. The final exam is scheduled for Tuesday, December 11 8 - 10:30 am. The final
exam is cumulative. Makeup examinations procedures as explained on page 65 of
the 2017-2018 Undergraduate Catalog will be followed. Students requesting makeup
examinations should expect a more difficult examination than that given during the
regularly scheduled exam time.

**Attendance:** Daily attendance in class is expected. You are allowed one unexcused
absence over the course of the semester. Two or more unexcused absences will affect your
grade. Your final grade will be reduced by 5 percentage points for every unexcused
absence beyond the first one. For example, if your final grade is 82% with 3 unexcused
absences, your final grade will be recorded as $82 - (3 - 1) \times 5 = 72$. 
Grades: Your grade will be based on homework, quizzes, tests, and a cumulative final exam. It will be calculated using the more favorable of the following two formulas:

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<th>Formula 1</th>
<th>Formula 2</th>
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<tbody>
<tr>
<td>Quizzes</td>
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<tr>
<td>Graded homework</td>
<td>15%</td>
<td>15%</td>
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<tr>
<td>Mid-term Exams</td>
<td>Each 15%</td>
<td>Two highest 20%</td>
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<td>Final</td>
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You need to keep your own grades to determine the current grade as D2L does not allow for averaging of makeup exams. The Excel spreadsheet I use is available on D2L. You should download the file and record the grades as I return your work. I will demonstrate after the first exam how to keep track of your current standing.

If you do not earn higher than a 55 on the final exam, you will not receive higher than a C- for your final grade regardless of your other grades in the course.

Grade cutoffs will be no higher than A: 93, A-: 90, B+: 87, B: 83, B-: 80, C+: 77, C: 73, C-: 70, D: 60.

Advice for surviving and thriving in this class:
I offer the following very simple but often ignored pieces of advice for your consideration:

1. Think!

2. Ask questions. Chances are, if you have a question, so do many other people in the class. I will assume that you, and your fellow students, understand the material unless you ask a question.

3. Take notes in class. If I write it on the board, it’s worth writing in your notes. Lectures proceed at such a pace that you will not grasp every detail when you first hear it. If you have good notes you will be able to go back through the lecture and understand all of the concepts and details you may have missed or not understood the first time through. When I pause in the lecture time, I’m pausing to allow you time to think and to fill in a gap in your notes. Don’t zone out.

4. Review your notes. Even if you think you understood everything from lecture, you will frequently find points you have missed or make connections between concepts on a second reading. Also, some professors can be so convincing in lecture that they make difficult concepts seem easy. You may find I’m one of those types of professors. Reading over your notes after lecture is a good way to make sure you really understood what was being presented. Three techniques other successful students have told me they use are:

   (a) copy over notes after class but write each step only when they can explain why it’s true
   (b) write out a good solution to the group work problems and explain why the solution is correct
   (c) write a list of failed approaches to the group work and a brief explanation of why the approach failed (a LOT of useful mathematics is learned from failed approaches)
5. Keep up with the reading and coursework. Mathematical concepts can take some time to really understand, and you will need to think about them (and sleep on them) a few times before you really get it. DO NOT put off your work and try to absorb everything the last day (FORGET THE LAST MINUTE - you are setting yourself up for failure!) I suggest that you plan to complete your work the day that it is assigned. The evening before it is due, review the work, and on the due date reread both the question and your solution.

6. Work with other people on your homework. Besides being more fun, checking your work with others will help you avoid those little mistakes that cost you time and points. Trying to explain a concept to someone else is an excellent test of how well you understand it yourself. (Reread my comments on group work under the Academic Integrity section.)

7. Memorize the definitions and be able to illustrate them with at least two examples. You will be asked to be clever on the homework and tests, but the tools you will use will always be the definitions (and theorems proved from the definitions). If you don’t know these definitions and previously proved theorems you will get nowhere. **The language of mathematics is very precise. Definitions are precise.**

8. Stay organized. When studying for the exams, your best resources are your old notes and homework. Keep these in order and you will have a good record of what the course is about. I will list the objectives for the topics on D2L. It will be up to you to fill in the details.

9. Do lots of problems. It’s very easy to listen to someone else explain something, or read about it, and think you understand. On exams you will be asked to solve problems using these concepts, and solving lots of problem is the best way to tell if you are prepared for a test. Re-solve old homework problems from scratch, and do similar ones on your own. The library has a great collection of books that have similar problems.

Take pride in your work and think!

**See you in class!**