Motivation
Scientists, economists, and others use mathematics to create models and perform calculations to gain a better understanding of the world. Mathematicians use abstraction and deductive reasoning to analyze quantity, shape, and structure. Math 212 Calculus II (continuous structures) and this course (discrete structures) help you transition from a user of mathematics to a creator of mathematics.

Learning Objectives
The student will
1. Use truth tables, symbolic logic, and proof schema to analyze and write definitions, conjectures, and proofs (logical thinking);
2. Describe informal representations, state formal definitions, and provide examples and nonexamples of basic set, function, relation, and graph concepts, and use these concepts to solve problems (relational thinking);
3. Use and create recursive definitions to solve problems, and use mathematical induction to prove theorems (recursive thinking);
4. Use addition and multiplication principles to count discrete structures and algorithmic steps (quantitative thinking);
5. Create, code, execute, and analyze algorithms (algorithmic thinking);
6. Learn mathematics by reading, listening, exploring, and conversing in an effective manner;
7. Explain and critique mathematical reasoning through speaking and writing in a precise and articulate manner in both informal and formal settings (communication);
8. Exhibit curiosity, playfulness, creativity, confidence, perseverance, interest in multiple perspectives, and a collaborative spirit (disposition).

Prerequisites
Grades of A or B in 3-4 years of high-school mathematics, including precalculus or advanced math. An SAT math score of 600 or more or an ACT score of 26 or more is highly recommended.

Instructor
David Housman, SC 117, dhousman@goshen.edu, 535-7405, 875-0339 (home)
Office hours posted on office door and on Moodle

Class Time
MWF 8:00-8:50 a.m. in AD 31.

Textbook

On-line
https://moodle.goshen.edu

Software
Wolfram Mathematica will be used for computation and is available from any lab computer. If desired, you can purchase or rent a student license for your personal computer at http://www.wolfram.com/mathematica/how-to-buy/education/students.html.

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.

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. If you do not understand something, write a question that is a specific as possible.

An average student can obtain an average grade with an average of nine hours each week devoted to this course—adjust if you are not average or desire a grade that is not average.

Moodle will announce the preparation for a class and the graded assignment to be completed before the next class. The preparation will typically involve reading a portion of the text and attempting a
selection of odd numbered exercises. During class, a pair of student presenters or the instructor will provide a brief reminder of the key points from the reading and detailed solutions for the selected exercises. All students will verify the correctness of the solutions, ask questions, and provide personal insights. At times, the entire class will engage in problem solving activities.

Grading

Course grades will be based on participation (10%), assignments (25%), three midterm exams (45%), and a comprehensive final exam (20%). If helpful, the final exam grade will replace one of the exam scores or one-half of the assignment score.

Participation

Come to class, present mathematical information to others, listen and critique the presentations of others, and fully engage in all activities. During two classes, you and a partner will present the main ideas of a portion of the text and solutions to exercises that everyone has been asked to explore.

Assignments

Achieve and exhibit understanding by completing the assigned exercises. You are encouraged to collaborate and seek assistance when having difficulties; however, you should eventually write your own solutions. 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. Assignments will be collected at the beginning of almost every class. Rewrites and late submissions will be assessed a 30% penalty and typically be due the second class after the original due date.

Exams

Exhibit your ability to solve problems and describe mathematical concepts without assistance or collaboration. A take-home portion that will be due when the in-class portion is taken.

Extra Credit

Receive extra credit toward your assignments grade by doing one or more of the following: (1) find errors in the text or posted course materials and describe the error in writing; (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. For any of these activities, the description should be two or three substantive paragraphs and be submitted to the instructor.

Tentative Schedule

<table>
<thead>
<tr>
<th>Topic</th>
<th>Chapters</th>
<th>Exam Date</th>
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</thead>
<tbody>
<tr>
<td>Logical Thinking</td>
<td>1</td>
<td>Friday, September 19</td>
</tr>
<tr>
<td>Relational Thinking</td>
<td>2</td>
<td>Monday, October 20</td>
</tr>
<tr>
<td>Recursive &amp; Quantitative Thinking</td>
<td>3 – 4</td>
<td>Monday, November 17</td>
</tr>
<tr>
<td>Everything</td>
<td>1 – 5</td>
<td></td>
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Tutoring and Disabilities

Goshen College wants to help all students be as academically successful as possible. If you have a disability and require accommodations, please contact Lois Martin, the Director of the Academic Resource & Writing Center early in the semester. In order to receive accommodations, documentation concerning your disability must be on file with the Academic Resource & Writing Center, Good Library 112, x7576, lmartin@goshen.edu. All information will be held in the strictest confidence. The Academic Resource & Writing Center offers tutoring and writing assistance for all students. For further information please see http://www.goshen.edu/campuslife/arwc/.

Collaboration and Academic Integrity

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.

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. For exams, you may not use any resources unless a specific exception is stated by the instructor.

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.

Due Date Policy

Class participation, assignments, projects, 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.