



Dr. Charles Rocca
Higgins Hall 101D
roccac@wcsu.edu
<http://sites.wcsu.edu/roccac>

MAT 141 - 01: Foundational Discrete Math
On Ground: Higgins 117, TF 2-3:15
Credits: 3 credit
Grading: Standard A-F



Office Hours:

Office hours are on ground for the Spring 2024 Semester. If you need to meet virtually we can make an appointment to do so via my WebEx Virtual Office:

Higgins 101-DV (<https://wcsu.webex.com/meet/roccac>)

- Monday, Tuesday, Thursday, & Friday: 12:45pm - 1:45pm
- Tuesday & Thursday: 3:30pm - 4:30pm
- or by appointment

Course Materials:

- Textbook: *Discrete Mathematics with Applications; 5th Edition*
by Susanna Epp (ISBN-13: 978-1337694193)

Course Description:

An in-depth introduction to discrete structures and processes such as counting techniques, sequences, indexed summations, introductory propositional and predicate logic, introductory induction and recursion, sets, relations, functions, graph theory and connections among these topics. This course is prerequisite to MAT 207: Proofs. Prerequisite: B or better in MAT 100 or appropriate placement. This course satisfies the general education QR competency.

Learning Outcomes:

Successful students in this course will be able to:

- Solve real-world problems using combinatorial techniques such as addition and multiplication principles, permutations, and combinations.
- Evaluate arithmetic and geometric summations.
- Interpret recursive definitions.
- Solve basic recurrence relations.
- Communicate mathematics using conventional terminology and notation related to combinations, permutations, summations, sets, functions, and relations.
- Demonstrate fluency with propositional and predicate logic, including computation of normal forms.
- Model real-life situations with propositional and predicate logic
- Describe strengths and limitations of propositional and predicate logic

- Determine whether mathematical statements are equivalent.
- Determine whether a statement is a tautology, contradiction, or neither.
- Negate mathematical statements precisely using logical principles such as De Morgan's laws.
- Use rules of inference to construct formal deductions in symbolic logic, and apply these to real problems (e.g., predicting the behavior of software or solving logical puzzles).
- Demonstrate computational fluency with operations on sets.
- Determine whether a given function is one-to-one, onto.
- Determine whether a given relation is reflexive, symmetric, transitive.
- Describe the equivalence classes for a given equivalence relation.
- Model practical situations using sets, functions, and relations.

Course Content:

Unit	Chapter(s)	Sections
Logical Statements	1, 2, & 3	1.1-1.4, 2.1-2.3, 3.1-3.4
Sequences and Summations	5	5.1, 5.6 & 5.7
Sets, Functions, Relations	6, 7, & 8	6.1, 7.1-7.3, 8.1-8.3
Counting and Combinatorics	9	9.2-9.7
Graphs	10	10.1, 10.2, & 10.4

Grading:

Text Assignments	20% (4% each)
Practice Exams	20% (4% each)
Unit Exams	45% (9% each)
Final Exam	15%

Text Assignments: For each unit you will be given a set of three to five application and/or theory problems from the text. You may work on these in groups of up to three students; if you do then, you must only hand in one copy of the assignment per group. All the work you turn in must be 100% your own. Representing work from any other source as your own will result in a 0% on the assignment; multiple infractions will lead to more significant consequences. **All text assignments must be written up neatly or be typed, and must be in complete sentences. Poor quality work can result in up to a 10% penalty.**

Practice Exams: For each exam there is a practice exam to help you prepare. You should start looking at these as early as possible so that you have time to ask questions. The practice exams are due at the time you come in to take the exam. As out of class work, practice exams must be written up in the same way as assignments.

Unit Exams: You will have a full period exam for each unit. In class exams will focus on basic definitions and skills. After you get the exam back you will be allowed to redo some of the questions on the exam in order to earn back up to 33% of the points you lost. As out of class work, all redoes must be written up in the same way as assignments.

Final Exam: The final exam, like the unit exams, will focus on definitions and skills. You will get a practice exam which counts for 10% of your final exam grade.

Course Calendar:

FRIDAY		TUESDAY	
1/19 Syl., Intro., & Section 2.1	1	1/23 Sections 2.2, 2.3	2
1/26 Sections 3.1, 3.2	3	1/30 Sections 3.2, 3.3	4
2/2 Sections 3.3, 3.4	5	2/6 <i>Exam 1 & Practice Exam Due!</i>	6
2/9 Section 5.1	7	2/13 Section 5.6, <i>Assignment 1:</i> §2.3: 38bc; §3.3: 57 & 58; §3.4: 32	8
2/16 <i>Presidents Day - No Class</i>		2/20 Section 5.7	9
2/23 Section 5.8	10	2/27 <i>Exam 2 & Practice Exam Due!</i>	11
3/1 Sections 6.1, 8.1	12	3/5 Sections 8.1, 8.2, <i>Assignment 2:</i> §5.1: 87; §5.6: 18acd; §5.7: 54	13
3/8 Sections 8.2, 8.3	14	3/12 <i>Spring Break - No Class</i>	
3/15 <i>Spring Break - No Class</i>		3/19 Sections 7.1, 7.2	15
3/22 Sections 7.2, 7.3	16	3/26 <i>Exam 3 & Practice Exam Due!</i>	17
3/29 <i>Day of Reflection - No Class</i>		4/2 Sections 9.2, 9.3	18
4/5 Sections 9.3, 9.4, <i>Assignment 3:</i> §6.1: 26; §7.2: 56; §7.3: 20; §8.2: 26	19	4/9 Section 9.5	20
4/12 Section 9.6	21	4/16 Section 9.7	22
4/19 <i>Exam 4 & Practice Exam Due!</i>	23	4/23 Section 10.1	24
4/26 Section 10.2, <i>Assignment 4:</i> §9.2: 28; §9.4: 8; §9.5: 17; §9.7: 16	25	4/30 Section 10.4	26
5/3 <i>Exam 5 & Practice Exam Due!</i>	27	5/7	28

Final Exam: Tuesday 5/7 at 2pm

Assignment 5: §10.1: 28 & 42; §10.4: 24 due 5/9/2024 by 3pm

Departmental Outline:

- I. Counting
 - 1. Fundamental Counting Principle
 - (a) Multiplication and addition principles
 - (b) Permutations
 - (c) Combinations
 - (d) Applications to discrete probability
 - 2. Pascal's triangle
 - (a) Pascal's identity
 - (b) The Binomial Theorem
- II. Sequences and Series
 - 1. Summation and product notation
 - 2. Summation formulas
 - (a) Sum of binomial coefficients
 - (b) Sum of finite arithmetic sequence
 - (c) Sum of finite geometric sequence
- III. Logic
 - 1. Propositional Logic
 - (a) Statements
 - (b) Boolean logical operators and truth tables
 - (c) Tautologies and contradictions
 - (d) Logical equivalence
 - (e) Conjunctive and disjunctive normal forms
 - (f) Negating statements and De Morgan's laws
 - (g) Conditional Statements
 - i. Converse and contrapositive
 - ii. Negations of conditional statements
 - iii. Biconditional statements and equivalents
 - (h) Valid and invalid arguments
 - i. Use of truth tables to determine whether an argument form is valid
 - ii. Rules of inference, including Modus Ponens and Modus Tollens
 - iii. Other rules of inference
 - 2. Formal Deduction - Predicate Logic
 - (a) Predicates and quantifiers
 - (b) Negations of quantified statements
- 3. Limitations and extensions of propositional and predicate logic
 - (a) First-order logic
 - (b) Higher-order logics
- IV. Sets
 - 1. Sets: basic definitions, terminology, and notation
 - 2. Set operations
 - (a) Venn diagrams and membership tables
 - (b) De Morgan's laws
 - (c) Cartesian Products
 - (d) Power Sets
 - 3. The subset relation
 - (a) Number of subsets of a finite set
 - (b) Number of subsets of a particular size
- V. Discrete Functions and Relations
 - 1. Functions
 - (a) Examples: cardinality, Boolean functions, sequences, summations
 - (b) Recursive definitions
 - i. Power functions
 - ii. Factorial functions
 - iii. Recursive defined sequences
 - (c) One-to-one and onto functions, bijections
 - 2. Relations
 - (a) Properties of relations
 - (b) Order relations
 - (c) Equivalence relations and equivalence classes
- VI. Graph Theory
 - 1. Terminology and Notation
 - 2. Euler Circuits
 - 3. Trees
 - 4. Adjacency Matrix

You and Your Grades:

- “A” (Exceptional) range 90% to 100%:
The student has demonstrated significant mastery of the appropriate knowledge and skills relevant to the course. The student is able to solve standard formulaic exercises and most nonstandard problems which require deeper insight.
 - “A” $\iff 92.5\% \leq \textit{Grade} \leq 100\%$
 - “A-” $\iff 90\% \leq \textit{Grade} < 92.5\%$
- “B” (Good) range 80% to 90%:
The student has demonstrated mastery of the appropriate knowledge and skills relevant to the course. The student is able to solve standard formulaic exercises and some nonstandard problems which require deeper insight.
 - “B+” $\iff 87.5\% \leq \textit{Grade} < 90\%$
 - “B” $\iff 82.5\% \leq \textit{Grade} < 87.5\%$
 - “B-” $\iff 80\% \leq \textit{Grade} < 82.5\%$
- “C” (Adequate) range 70% to 80%:
The student has demonstrated adequate mastery of the appropriate knowledge and skills relevant to the course. The student is able to solve most standard formulaic exercises but struggles with nonstandard problems which require deeper insight.
 - “C+” $\iff 77.5\% \leq \textit{Grade} < 80\%$
 - “C” $\iff 72.5\% \leq \textit{Grade} < 77.5\%$
 - “C-” $\iff 70\% \leq \textit{Grade} < 72.5\%$
- “D” (Inadequate) range 60% to 70%:
The student has demonstrated inadequate or incomplete mastery of the appropriate knowledge and skills relevant to the course. The student is able to solve some standard formulaic exercises but few if any nonstandard problems which require deeper insight.
 - “D+” $\iff 67.5\% \leq \textit{Grade} < 70\%$
 - “D” $\iff 62.5\% \leq \textit{Grade} < 67.5\%$
 - “D-” $\iff 60\% \leq \textit{Grade} < 62.5\%$
- “F” (Unacceptable) below 60%:
The student has demonstrated essentially no mastery of the appropriate knowledge and skills relevant to the course. The student is unable to solve most standard formulaic exercises and essentially no nonstandard problems which require deeper insight.

End User Agreement:

General Expectations: As a student in this class you are expected to:

- attend class and take notes,
- actively read material in each section, taking notes,
- review your notes on a regular basis,
- check your university email every day,
- check the class site *at least* every other day,
- begin studying for exams in a timely fashion,
- ask questions early and often,
- attend office hours,
- seek help in the math clinic or tutoring center, and
- complete assignments and readings on time.

Assignment Guidelines: (These apply to *all out of class work*.)

- Work handed in must always look neat, legible, and professional. Work must be very neatly written or preferably typed. The quality of your work will be factored into your grade, up to 10%, in extreme cases work may be rejected and then counted as late.
- Answers on all assignments should be given in complete sentences. I should be able to tell what your answer means without re-reading the problem. This does not mean you simply rewrite the question.
- An assignment is considered late after I have handed it back or gone over it in class. Late assignments are accepted but may receive at most 75% credit. Late assignments go to the absolute bottom of the stack of papers to be graded; *all on time work is graded before any late work*.
- If you work on an assignment as part of a group, then there may be no more than three individuals in the group and all your names must be on the assignment. You should hand in only one copy of the work.
- All work must be submitted in the manner directed.

Email Etiquette Guidelines: When sending an email you must include the course number and semester in the subject line. For example, if you are taking MAT 314 in Fall 1592 then the the subject line should begin with “[MAT 314 Fall 1592].” Also, you should always begin with a salutation such as “Dear Dr. Rocca” and end with a closing such as “Sincerely, I. Newton.”

Exam Makeup Policy: To qualify for a makeup exam you must have a valid reason for missing the exam and, if at all possible, let me know ahead of time that you are missing the exam. You will need to meet with me in order to arrange a time for the make up exam. If you do not have a valid reason, do not give prior notice when possible, or simply do not show up for an exam, you are not entitled to a makeup and will not be given one. If you fail to show up for your makeup exam, you will not be given a second opportunity.

The 2% Exception: Any quiz or class work which is ultimately worth no more than 2% of your final grade can not be made up.

Time on Task: As a 3 credit class you should expect to average 7.5 to 8.5 hours of work a week including class time. Some weeks you may get away with less and some may require more.

Attendance: There is no specific policy for attendance in this course. However, if you have *three consecutive unexcused absences* within the first half of the semester I am required to report to the University that you have *stopped attending*.

Academic Honesty: If on any assignment, quiz, or exam you turn in someone else’s work, regardless of the source, as if it were your own you will receive a zero on that assignment, quiz, or exam. If you are caught doing this three times you will receive an F in the course and the Dean will be informed of your academic dishonesty.

(<https://www.wcsu.edu/faculty-handbook/2019-2020/policies-pertaining-to-students/academic-honesty-policy/>)

Accommodations: If you have need of an accommodation for testing or note taking, please visit AccessAbility Services, located in the HAAS Library room 406 (<http://www.wcsu.edu/accessability>).