BOB JONES UNIVERSITY
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Ma 303 Discrete Math

Spring/2024

College of Arts and Sciences
Division of Mathematical Sciences

Professor:	James A. Knisely, Ph.D.
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Office Hours:	MWF 8:00-8:50 a.m. TTH 8:30-9:45 a.m. Other times by appointment.
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Communication Policy:	For class questions that all students might benefit from, please use the class specific MS Teams team. For other types of questions or notifications, please use the chat feature of MS Teams or email. Most questions involving short answers are responded to within four hours, others within 24 hours. Please email or message if you desire a meeting so that a location can be agreed upon that allows for privacy, help, and appropriate distancing.
Classroom/Meets:	AL 302 / MWF 9:00 - 9:50 a.m.
Credit/Load:	3/3
Textbook(s):	*Discrete and Combinatorial Mathematics* (5th edition) by Ralph Grimaldi

Catalog Description:

An introduction to set theory, elementary combinatorics, number theory, recurrence relations, graph theory, and finite state machines.

Course Context:

Discrete Math fulfills goals for three varied groups: math education majors, computer science majors, and students desiring to fulfill the liberal arts core. Most, if not all, of this course's objectives are aligned with the NCTM standards for Math Ed students. Additionally, the course's content attempts to meet the suggestions in ACM's CS2013 Curriculum Guide.

Course Goals:

1. To develop a Christian perspective of Discrete Math and related scientific endeavor
2. Develop Christ-like qualities such as perseverance, diligence, and dependence on God.
3. To develop mathematical maturity and independent thinking
4. To develop a greater appreciation for the beauty and power of discrete mathematics.
5. To develop a greater interest in exploring mathematical ideas independent of the teacher
6. To prove the products and processes of discrete mathematics.
7. To develop mathematical modeling and problem solving skills with the power of discrete mathematics tools

Course Objectives:

With at least 70% accuracy, the student will be able to do the following:

1. Write the definitions of all terms and concepts of set theory, elementary combinatorics, properties of integers, functions and relations. (NCTM 2, 13) *Evaluated in each in-class chapter test and some quizzes.*
2. Prove certain important theorems of discrete mathematics such as the Binomial Theorem, the Division Algorithm, the Fundamental Theorem of Arithmetic, and Euler's Theorem (for planar graphs). (NCTM 2, 13) *Evaluated in each in-class chapter test.*
3. Produce counting arguments which solve both ordered and unordered selection when replacement is either allowed or disallowed. (NCTM 13, 14) *Evaluated in chapter 1 test and quizzes.*
4. Produce an argument involving the Pigeonhole Principle. (NCTM 2, 13) *Evaluated in test covering chapters 5 and 7.*
5. Use calculator to determine if a number is a Mersenne prime, to perform the Euclidean Algorithm, and to solve recurrence relations. (NCTM 6, 13) *Evaluated in chapter 4 test and quizzes over chapter 10.*
6. Demonstrate the ability to use electronic sources to investigate discrete mathematics concepts including a historical development of discrete mathematics. (NCTM 8, 13) *Evaluated in two historical figures assignments.*
7. Solve discrete mathematics problems related to real-world applications. (NCTM 1, 4, 5, 8, 10) *Evaluated in each in-class chapter test and the final exam.*

Course Content:

A. Set Theory and Quantifiers
   1. Sets and Subsets
   2. The Use of Quantifiers
   3. Set Operations and the Laws of Set Theory
   4. Quantifiers, Defintions, and the Proofs of Theorems

B. Relations and Functions
   1. Cartesian Products and Relations
   2. Functions: Plain and One-to-One
   3. Onto Functions: Stirling Numbers of the Second Kind
   4. The Pigeonhole Principle and Ramsey Theory

C. Properties of Relations
   1. Partial Orders: Hasse Diagrams
   2. Equivalence Relations and Partitions

D. Languages: Finite State Machines
   1. Language: The Set Theory of Strings
   2. Finite State Machines

E. Recurrence Relations
   1. The First-Order Linear Recurrence Relation
   2. The Second-Order Linear Homogeneous Recurrence Relation with Constant Coefficients

E. Properties of the Integers: Mathematical Induction
   1. The Well-Ordering Principle: Mathematical Induction
   2. Recursive Definitions
   3. The Division Algorithm: Prime Numbers
   4. The Greatest Common Divisor: The Euclidean Algorithm
   5. The Fundamental Theorem of Arithmetic

F. Gaussian Integers and Dedekind's Creation of an Ideal
   1. Introduction
   2. The Gaussian Integers
   3. Gaussian Primes, and the Sum of Two Squares
   4. Gaussian Primes and Unique Factorization
   5. Uniqueness Lost?

G. An Introduction to Graph Theory
   1. Definitions and Examples
   2. Subgraphs, Complements, and Graph Isomorphisms
   3. Vertex Degree: Euler Trails and Circuits
   4. Planar Graphs
   5. Hamilton Paths and Cycles
   6. Graph Coloring and Chromatic Polynomials

General Policies:

Calculator Requirements:

TI-89 or TI-nSpire calculator is required

Prerequisites:

Sophomore standing or above.

Course Readings:

A. Textbook should be read thoroughly. Students are responsible for all of the information in the textbook even if not discussed in class

B. Students will need to do two web assignments on the impact of a mathematician in a particular branch of mathematics.

Planned Lecture Schedule

The current lecture schedule is located at Proposed Lecture Schedule.

Projected Points:

Category	Points
Final	150
Tests	262
Quizzes	75
Homework	80
History	20
Projects	113
Total	700

Grading Scale:

90% - 100%	A
80% - 89%	B
70% - 79%	C
60% - 69%	D

Quizzes:

The quizzes are listed on the schedule page. There will be no makeup quizzes.

Primary Sources Project: Gaussian Integers

We will be using a Primary Sources Project (PSP) on Gaussian Integers after covering chapter 4. We will use it to see generalizations of the ring of integers.

History and Historical Figures:

Historical figures are discussed at the end of each chapter. Two web assignments will be given (one from covering chapters 2, 3, 4, 5 and the other covering chapters 6, 7, 10, 11, and 14). Each student will choose two individuals to investigate. The student will find and submit a web article for each individual as well as submit one paragraph synopses of each article.

Homework:

- The assigned problems for homework are every fourth problem from each section beginning at the first problem.
- The homework for each chapter will be handed in at the beginning of the period on the day of the chapter test over that material.
    - Homework must be neat and well organized. Section numbers and page numbers should appear at the beginning of each new section.
    - Homework should be worked out in detail. Answers alone are not acceptable.
- Each homework assignment will be worth approximately 20% of the corresponding test. *Homework not turned in when due is late and is subject to a late penalty of up to 25% off.*
- You are responsible for checking all of your homework problems from the answers in the back of the book. Do not copy the answers but use the Guides as a resource to learn the material that you are expected to know.

Cell Phones and Laptops:

Cell phones are not permitted to be out during class. Make sure they are muted and do not ring during class. There is little reason why a laptop should be used during a math class. You should have pencil, paper, and your textbook out and ready to use in class. If for some reason you have a legitimate need of a laptop in class, please see me and we will discuss this need.

Academic Penalty for Absences:

For planned absences, you are expected to notify me a week ahead of time; you can do so by e-mailing me. Scheduled tests should be taken before your planned absence; please contact me to make arrangements for doing so. For absences due to incapacitating illness or emergency, you should contact me as soon as you realize you will not be in class in order to make arrangements for making up any tests without penalty. In other circumstances, tests must be made up within one week of your return, with a 10 percent grade penalty for that test. Each subsequent missed test will result in an additional 10 percent penalty. The lowest quiz grade will be dropped when calculating final grades. Missed quizzes due to absence of any kind will not be made up.

Academic Integrity:

You are expected to uphold the school standard of conduct relating to academic honesty: School standard of conduct – The link can be found on the BJU Policies page.

You must assume full responsibility for the content and integrity of the academic work you submit. The guiding principle of academic integrity is that your submitted work; examinations, reports, and projects must be your own work. Misrepresenting your work is unethical in any setting. In an academic setting, it is a breach of the university policies.

Copyright Policy: