MATH 2420, SECTION 004, DISCRETE MATHEMATICS, SYLLABUS
SPRING 2024 (CRN: 12948)

INSTRUCTOR: YONGWEI YAO Office: 1431, 25 PARK PLACE
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Office Hours: 12:00--1:30PM, MONDAYS & WEDNESDAYS, VIA WEBEX (URL ON ICOLLEGE)
COURSE TIME: 11:00AM--12:15PM, TUESDAYS & THURSDAYS, AT 209 CLASSROOM SOUTH

PREREQUISITE:
A grade of C or higher in MATH 1113 (Pre-calculus) or Math 1220 (Survey of Calculus)

REQUIRED TEXT:
WebAssign supplemental website: http://webassign.net/. Signing up for a WebAssign account is a required component of the class since it will be used for assigning graded online homework. Moreover, the entire textbook is available electronically on the website, as well as additional study and review resources. Use the following class key to sign up for our class on WebAssign: **GSU38920327**

TEXTBOOK (optional, electronic copy available on WebAssign):
Discrete Mathematics with Application, 5th Edition, by Susanna Epp

COURSE DESCRIPTION:
Introduction to discrete structures that are applicable to computer science. Topics include number bases, logic, sets, methods of proof, Boolean algebra, properties of relations, and elementary concepts of graph theory. This is a 3 credit-hour course.

COURSE CONTENT: Please note that only listed sections will be covered.

Chapter 1: Speaking Mathematically (1.1, 1.2)
Chapter 2: The Logic of Compound Statements (2.1, 2.2, 2.3, 2.5)
Chapter 3: The Logic of Quantifies Statements (3.1, 3.2, 3.3, 3.4)
Chapter 4: Elementary Number Theory and Methods of Proof (4.1, 4.2, 4.3, 4.4, 4.5, 4.6)
Chapter 5: Sequence, Mathematical Induction, and Recursion (5.1, 5.2, possibly 5.3 & 5.4 as well)
Chapter 6: Set Theory (6.1, 6.2)
Chapter 7: Properties of Functions (7.1, 7.2, possibly 7.3 as well)
Chapter 8: Properties of Relations (8.1, 8.2, 8.3)
Chapter 10: Theory of Graphs and Trees (10.1, 10.2)

MATH 2420 is a Core IMPACTS course that is a part of the Mathematics and the Technology, Mathematics, and Sciences (STEM) areas.

Core IMPACTS refers to the core curriculum, which provides students with essential knowledge in foundational academic areas. This course will help students master course content, and support students' broad academic and career goals.

This course should direct students toward the following broad Orienting Questions:

- How do I measure the world?
- How do I ask scientific questions or use data, mathematics, or technology to understand the universe?

Completion of this course should enable students to meet the following Learning Outcomes:

- Students will apply mathematical and computational knowledge to interpret, evaluate, and communicate quantitative information using verbal, numerical, graphical, or symbolic forms.
- Students will use the scientific method and laboratory procedures or mathematical and computational methods to analyze data, solve problems, and explain natural phenomena.

Course content, activities, and exercises in this course should help students develop the following Career-Ready Competencies:

- Information Literacy
- Inquiry and Analysis
- Problem-Solving
- Teamwork

COURSE ASSESEMENT:

a. Tests (45%): There will be three tests. Each test will contribute 15% to your course grade. Students will have to complete the test within 1 hour and 15 minutes.

b. Online homework (15%): There will be online homework assignments on the WebAssign website throughout the semester. Average of all homework grades will contribute 15% to your course grade. Lowest two homework grades will be dropped.

c. Quizzes (20%): Quizzes will be given in the classrooms. Two lowest quiz grades will be dropped.

d. Final Exam Final (20%): The comprehensive final exam is scheduled on Thursday, April 25th, 2024, from 10:45am to 1:15pm. If the final exam grade is better than your lowest test grade, then that test grade will be replaced by the final exam grade. Missing the final exam will result in a grade of **F** for the course.

Grading Scale: 97-100%----A+; 93-96 %----A; 90-92%----A-; 87-89%----B+; 83-86%----B; 80-82%----B-; 77-79 %----C+; 70-76%----C; 60-69%----D; 0-59%----F.

MAKE UP POLICY:

NO MAKE UP WILL BE GIVEN FOR HOMEWORKS, QUIZZES, AND ANY IN CLASS ASSIGNMENTS.

NO make up for the final exam. Absence from the final exam will result in a grade of F for the course.

Policy for make up of the test:

GSU has a process for students seeking excused absences through the Dean of Students (DOS) Office. In case of an emergency, students must promptly submit documentation to https://deanofstudents.gsu.edu/student-assistance/professor-absence-notification/. Professors will then be notified by the DOS of any excused absences without the need to manage medical or other pertinent information individually. Making up missed graded assignments is allowed **only** when we receive such a notification from the DOS Office.

STUDENT CODE OF CONDUCT STATEMENT:

The university's disruptive student policy applies and students should familiarize themselves with the relevant parts of the student code of conduct at: http://codeofconduct.gsu.edu/."

UNAUTHORIZED PUBLIC POSTING AND DISTRIBUTION:

The selling, sharing, publishing, presenting, or distributing of instructor-prepared course lecture notes, videos, audio recordings, or any other instructor-produced materials from any course for any commercial purpose is strictly prohibited unless explicit written permission is granted in advance by the course instructor. This includes posting any materials on websites such as Chegg, Course Hero, OneClass, Stuvia, StuDocu and other similar sites. Unauthorized sale or commercial distribution of such material is a violation of the instructor's intellectual property and the privacy rights of students attending the class, and is prohibited. Failure to abide by these limitations constitutes a violation of the Policy on Academic Honesty and will be treated accordingly.

COMMUNICATION POLICIES:

Since we will be working with one another at a distance, it is important for us to have an efficient and effective means to communicate. Please note the following email guideline for this course. Emails will be returned within a 24 hour period. Over a weekend, allow 48 hours for a response. All emailing will be done through your GSU email. Or you may come to talk to me during office hours listed at the top of syllabus.

WITHDRAWAL DATE:

The last day to withdraw from class and be eligible for a grade of "W" is **Tuesday, February 27th, 2024.**

OTHER FACULTY-INITIATED WITHDRAWL: If you stop attending the course before the semester midpoint (Feb. 27th, 2024), you may be administratively withdrawn from the course and receive a withdrawal grade. Attending the course implies consistent class attendance and active involvement both on iCollege and on WebAssign. Failure to meet the following requirements will be considered as lack of attendance:

1. If you do not attend any of the class periods during the first week of the semester, you may be administratively withdrawn from the class for non-attendance.
2. If you do not register for WebAssign with your instructor's class key during the first week of the semester, you may be administratively withdrawn from the class for non-attendance.

3. If you create a WebAssign account and have an average of less than 50% for all homework through section 2.5 by the end of the third week, you may be administratively withdrawn from the class for non-attendance.
4. If you create a WebAssign account and have an average of less than 50% for all homework through section 4.2 by the semester midpoint, you may be administratively withdrawn from the class as "stopped attending".

ACADEMIC HONESTY POLICY:

Cheating/plagiarism will not be tolerated on any work. A first occurrence will result in a grade of 0 on the assignment for all concerned parties as well as an Academic Dishonesty form being filed with the Dean of Students. A second occurrence will result in a grade of F for the course for the concerned parties and a second Academic Dishonesty form being filed. (See also the University's policy on Academic Honesty at http://codeofconduct.gsu.edu/.)

ACCOMMONDATIONS:

Students who wish to request accommodation for a disability may do so by registering with the Access & Accommodations Center (AACE), Email: access@gsu.edu, Web: https://access.gsu.edu/, Phone: 404-413-1560. Students may only be accommodated upon issuance by the Office a signed Accommodation Plan and are responsible for providing a copy of that plan to instructors of all classes in which accommodations are sought. Students eligible for extra time will be given additional time for the tests as indicated in the Letter of Accommodation. However, no additional arrangement will be made for the online assignments as this privilege is already incorporated in the online assignments.

COURSE EVALUATION AND EVOLUTION:

Your constructive assessment of this course plays an indispensable role in shaping education at Georgia State. Upon completing the course, please take the time to fill out the online course evaluation.

IMPORTANT DATES:

- Exam-1: Thursday, February 8th, 2024
- Midpoint: Tuesday, February 27th, 2024
- Exam-2: Tuesday, March 5th, 2024
- Exam-3: Tuesday, April 9th, 2024
- MATH 2420 Final Exam: 10:45am--1:15pm, Thursday, April 25th, 2024

The course syllabus provides a general plan for the course; deviations may be necessary.

As a result of completing the course Discrete Mathematics, MATH 2420, students will be able to:

1. Identify logical form, form compound statements using the connectives and, or and not, determine truth tables of more general compound statements, determine whether two statement forms are logically equivalent or nonequivalent, apply De Morgan's laws to form negations of and and or, determine whether a statement is a tautology or a contradiction, and use logical equivalences to simplify statement forms.

2. Determine truth tables for compound statements containing conditional and biconditional connectives, represent if-then as or, and then use this representation to negate an if-then statement, determine the negation, contrapositive, converse and inverse of a conditional statement, rewrite a conditional statement as an "only if" statement, and as sufficient and necessary conditions.

3. Determine whether and argument is valid or invalid, use valid argument forms such as modus ponens, modus tollens, etc. to do complex deductions, and illustrate a proof by contradiction using the knights and knaves example.

4. Give the input/output table for the following gates: OR, AND and NOT, find a Boolean expression (input/output table, respectively) of a circuit, find a circuit corresponding to a Boolean circuit (input/output table, respectively) by finding the disjunctive-normal or sum of products form, determine whether two logical circuits are equivalent, and simplify a combinatorial circuit.

5. Represent a binary (hexadecimal, octal) number as a decimal number, represent a decimal (hexadecimal, octal) number in binary notation, represent a binary number in hexadecimal (octal) notation, and add and subtract binary numbers.

6. Determine the domain and the truth set of a predicate variable, identify universal and existential statements, be able to write these statements in formal and informal language, and identify universal conditional statements, negate universal and existential statements, as well as statements containing both universal and existential statements.

7. Define an even (odd) integer, prove an existential statement using an example, use a direct proof to prove universal statements such as "The sum of an even integer and an odd integer is odd", "If the difference of any two integers is odd, then so is their sum", etc., disprove a universal statement by an example, follow the directions for writing proofs of universal statements, and identify common mistakes in proving statements.

8. Use direct proofs or counterexamples to prove or disprove statements involving the rational numbers.

9. Use direct proofs or counterexamples to prove or disprove statements involving the divisibility of integers, and use the quotient remainder theorem to illustrate a proof by division into cases.

10. Use methods of proofs by contradiction and contraposition to prove various statements.

11. Find the explicit formula for a sequence, and be able to do calculations involving factorial, summation and product notations.

12. Be able to prove statements using mathematical induction.

13. Determine whether one set is a subset of another, whether two sets are equal, whether an element is in a set or not, be able to determine the union, intersection, difference and complement of sets, illustrate sets using Venn diagrams, determine the Cartesian product of two or more sets, prove set identities, use set identities to derive new set properties from old set properties, use Venn diagrams to prove set identities, determine whether sets form a partition of a given set, and determine the power set of a set.

14. Determine whether a relationship is a function or not, determine the domain, co-domain, range of a function, and the inverse image of x, prove or disprove whether a function is one-to-one or not, determine whether a function is onto or not, determine the inverse of a one-to-one correspondence, determine the composition of two functions, and show that if two functions are one-to-one (onto) so too is their composition.

15. Determine the arrow diagram of a relation, whether a relation is a function or not, determine the inverse of a relation, whether a relation is reflexive, symmetric or transitive, determine the transitive closure of a relation, show that the binary relation induced by a partition is an equivalence relation, and show that the set of equivalence classes of an equivalence relation on A forms a partition of A.

16. Identify loops, parallel edges, etc. in a graph, draw the complete graph on n vertices, and the complete bipartite graph on (m,n) vertices, determine whether a graph is bipartite or not, list all the subgraphs of a given graph, determine the degree of a vertex in a graph, prove that the sum of the degrees of the vertices is equal to twice the number of edges, show that in any graph there is an even number of vertices of odd degree, apply these results, and determine the complement of a simple graph.

17. Determine whether a walk is a path, simple path, closed walk, circuit or a simple circuit, determine whether a graph is connected or not, prove that a graph has an Euler circuit if and only if the graph is connected and every vertex of the graph has even degree, determine whether a given graph has an Euler circuit and, if so, indicate one, prove that a graph has an Euler path if and only if the graph is connected and has exactly two vertices of odd degree, determine whether a given graph has an Euler path and, if so, indicate one, and determine whether a graph has a Hamiltonian circuit and, if so, indicate one.

18. Determine whether a graph is a tree or not, show that any tree with more than one vertex has two leaves, show that any tree with n vertices has n-1 edges, show that if G is an connected graph with n vertices and n-1 edges, then G is a tree, determine in a rooted tree, the root, level of a given vertex, height of the tree, children, parent, siblings, ancestors and descendants of a vertex, determine whether a given tree is a binary or full binary tree, and prove results regarding binary trees.

19. Apply Kruskal's algorithm or Prim's algorithm to determine a minimal spanning tree for a given graph.

Math 2420, Spring 2024, Pacing Calendar

	Date	Tuesday	Thursday
Week-1	Jan. 8-12	Syllabus, 1.1, 1.2	2.1
Week-2	Jan. 15-19	2.2, 2.3	2.5, Quiz 1
Week-3	Jan. 22-26	3.1, 3.2	3.2, Quiz 2
Week-4	Jan. 29-Feb. 2	3.3	3.4, Quiz 3
Week-5	Feb.5-9	4.1	Exam-1 (up to 3.4)
Week-6	Feb. 12-16	4.2, Quiz 4	4.3
Week-7	Feb. 19-23	4.4, Quiz 5	4.5, 4.6
Week-8	Feb. 26-Mar. 1	5.1, 5.2, Quiz 6	5.3, 5.4
Week-9	Mar. 4-8	Exam-2 (up to 4.6)	6.1, 6.2
Week-10	Mar. 11-15	SPRING BREAK	SPRING BREAK
Week-11	Mar. 18-22	6.2, 7.1, Quiz 7	7.1, 7.2
Week-12	Mar. 25-29	7.3, 8.1, Quiz 8	8.1, 8.2
Week-13	Apr. 1-5	8.3, Quiz 9	10.1
Week-14	Apr. 8-12	Exam-3	10.2
Week-15	Apr. 15-19	10.2, Quiz 10	Review for final exam
Week-16-17	Apr. 23-30	FINAL EXAM WEEK	Final on 4/25, at 10:45am