CS 3653: Discrete Mathematics

Course Credit: 3.00

Instructor: Manaswini Pradhan, PhD
Class Schedule: 10:30am-11:45am Tuesday/Thursday (Classroom Building, Room 301)
Office hours. Tu/Th 2:05pm-2:35pm/Tu 8:30-9:25am or by appointment (CS 224)
Course home page: **Canvas**

Overview

Theory and applications of discrete mathematical models, fundamental to analysis of problems in computer science. Formalisms underlying the specification, design, and analysis of software, including propositional and predicate logic, sets, relations and functions, discrete probability, proof techniques, basics of counting, recursive definition and induction, undirected and directed graphs, Boolean algebra.

Course Outline

1. Propositional and Predicate Logic
2. Sets
3. Relations
4. Functions
5. Proof Techniques
6. Basics of Counting and Discrete Probability
7. Graphs and Trees

Topics

- Propositional logic and Boolean algebra: logical connectives, truth tables, inference rules
- Predicate logic: quantification, implication, proofs, applications to programming
- Discrete structures: Set union, intersection, complement, Cartesian product, cardinality, power sets; Relations and their properties including reflexivity, symmetry, transitivity, equivalence, partial orders, representation and manipulation as graphs: Functions and their properties including surjections, injections, bijections, inverses, composition; applications in computing such as relational databases
- Induction: proofs, relation to recursive programming
- Counting and Discrete Probability: The basics of counting, Principle, Permutation and Combinations Recurrence Relations
- Graphs and Trees: Graphs and Graph Models, Tree traversal and applications

Outcomes

Upon completion of this course, students will demonstrate ability to:

[Logic] Convert logical statements from informal language to propositional and predicate logic expressions; apply formal logic to model and analyze the correctness of software constructions; inductively prove properties of recursively defined functions. Formulate and manipulate logic expressions for a variety of applications.

[Discrete structures] Use sets, functions, and relations to model software problems and solutions. Understand formal definitions of machine models. Supports many areas of computer science (design and analysis of algorithms, complexity theory, artificial intelligence, programming etc.)

[Counting Techniques] Recognize problems that have applications of inclusion-exclusion algorithmic solution, combinatorics and probability.

[Graphs and Trees] Use of graphs and trees to devote to the notion of networks. Application to the social network, data networking, business and the internet, biological sciences and motivating applications for connectedness of various components and hierarchy study.

Readings

Background on most topics covered in this course is easily found on the web; useful resources on particular topics are mentioned in class. However, I will utilize the following books as text and reference books:

Text book:

- Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th Ed., McGraw Hills. ISBN: 9780073383095

Other References:

- Critchlow, Carol, and David Eck. Foundations of Computation. (available online at http://math.hws.edu/FoundationsOfComputation/).
- Lehman, Eric, F Thomson Leighton, and Albert R Meyer. Mathematics for Computer Science. (available online at https://courses.csail.mit.edu/6.042/spring17/mcs.pdf)

You will also be expected to work through several online tutorials and related readings.

Course Gradings Requirements

Grading Criteria

Subject to minor change:

Two exams (60%)

Mid Term Exam (30%)
Final Exam (30%)
Exam questions cover questions from propositional logic and Boolean algebra, predicate logic, discrete structures, induction, recursion counting, graphs, trees.

10 Weekly quizzes (40%)

Each quiz is worth 4 points.

Total (100%)

Grading Scale

90% -- 100%	A
80%-- 89.99%	B
70%-- 79.99%	C
60%-- 69.99%	D
Less than 60%	F

Note: The total grades shown in Canvas may NOT reflect the proportions above. So, do your own calculation for grades using the proportions.

Assignments:

There will be around weekly assignments throughout the semester.

Late penalty is 10% per class day. Assignments turned after a week late from the due date will not be accepted.

Assignment Submissions rules and practices:

1) All home assignments/quizzes will be submitted **ONLY** through Canvas.

2) When naming your home assignments, you **MUST** use the naming convention below:
a. All files should be collected under one folder and zipped, before submitting.
b. The folder should be named as: Assignment**_LastName_FirstName_XX. **(where ** means assignment number and XX means question number)**
Example: **Assignment01_Andrew_Simon_03**

Failure to submit in this order will automatically results in 5 points deduction.

3) You are encouraged to review the assignments when assigned (even if you don't have time to work on them right then). This way you can plan out your week and get your questions answered early. Please note that **not all assignments will be of same complexity**.
4) Any extra effort (in terms of introducing new ideas or concepts, detailed implementation and so on) will be encouraged and may be rewarded with extra bonus points.

Attendance

Attendance is very important for this class. Late arrival is not encouraged. Students are responsible for knowing all the **verbal (announcement)** and written information provided by the instructor during class, including those are posted on the course web page.

Course and Class regulations

If you are having trouble understanding a concept, please contact me inside the class or in my office during office hours. Please feel free to make constructive suggestions at any time including making comments anonymously.

I encourage, and reward, individual efforts to build a community of active learners. Efforts to participate in class will be awarded **points** in the class.

- Deadlines are final and must be met. It is your responsibility to allocate time accordingly.
- Exams: No make-up exams will be given unless an acceptable University-approved excuse is provided promptly. Exams will be closed books and notes with no crib sheet. Calculators that can store texts and diagrams will not be allowed.
- Collaboration are allowed only in terms of concepts, ideas or techniques are allowed. However, each student needs to have their own implementation, write-ups and approach. Any violation of academic integrity would result in a zero grade and a report to the university administration. Major violation will result in a grade F.
- Please adhere to professional behavior in class. Refrain from side conversations, surfing the internet on personal devices, answering phones/ texting, etc.
- Students with disabilities who may require reasonable accommodations should contact Office of Disabled Student Service, 326 Student Union. Please advise the instructor of such disability and the desired accommodation at some point before, during or immediately after the first scheduled class period.

Advice for performing well in this class

- Attend the class regularly and turn in the weekly quizzes well in time.
- Keep up with the weekly assignments/quizzes, since many of the concepts build upon each other.
- Review the assignments when assigned (even if you don't have time to work on them right then). This way you can plan out your week and get your questions answered early. Do not wait until the last minute to work on an assignment at home.
- Turn in the quizzes/assignments well in time.
- Manage the time especially at the mid-term examination and end of the semester with the final examination.

OSU Academic Integrity Policy:

OSU is committed to maintaining the highest standards of integrity and ethical conduct. This level of ethical behavior and integrity will be maintained in this course. Participating in a behavior that violates academic integrity (e.g., unauthorized collaboration, plagiarism, multiple submissions, cheating on examinations, fabricating information, helping another person cheat, unauthorized advance access to examinations, altering or destroying the work of others, and altering academic records) will result in an official academic sanction. Violations may subject you to disciplinary action including the following: receiving a failing grade on an assignment, examination or course, receiving a notation of a violation of academic integrity on your transcript, and being suspended from the University. You have the right to appeal the charge. Go to http://academicintegrity.okstate.edu/ for a video on OSU's academic integrity policy and additional information.

Tentative Course Schedule:

Class	Date	Topics	Chapter
1	08/20	The Foundations: Logic and Proofs	1
2	08/22	The Foundations: Logic and Proofs	1
3	08/27	The Foundations: Logic and Proofs	1
4	08/29	The Foundations: Logic and Proofs	1
5	09/03	Basic Structures: Sets, Functions, Sequences, Sums and Matrices	2
6	09/05	Basic Structures: Sets, Functions, Sequences, Sums and Matrices	2
7	09/10	Basic Structures: Sets, Functions, Sequences, Sums and Matrices	2
8	09/12	Basic Structures: Sets, Functions, Sequences, Sums and Matrices	2
9	09/17	Algorithms	3
10	09/19	Algorithms	3
11	09/24	Number Theory and Cryptography	4
12	09/26	Number Theory and Cryptography	4
13	10/01	Induction and Recursion	5
14	10/03	Induction and Recursion	5
15	10/08	Counting	6
16	10/10	Counting	6
17	10/15	Mid Term Examination	
18	10/17	Discrete Probability	7
19	10/22	Discrete Probability	7
20	10/24	Advanced Counting Techniques	8
21	10/29	Advanced Counting Techniques	8
22	10/31	Relations	9
23	11/05	Relations	9
24	11/07	Relations	9
25	11/12	Graphs	10
26	11/14	Graphs	10
27	11/19	Graphs	10
28	11/21	Trees	11
29	11/26	Trees	11
	11/28	Thanksgiving break, Classes recessed	
30	12/03	Boolean Algebra	12
31	12/05	Boolean Algebra	12
32	12/10	Final Exam	
This is just a tentative course schedule. It may evolve throughout the semester			