

Math 2358 – Discrete Mathematics I

Roberto Barrera

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Course Description

This course is a study of discrete mathematical structures commonly encountered in computing hardware and software. Topics include logic, functions, elementary set theory, proof techniques, mathematical induction, numeric sequences, elementary number theory, and graph theory.

Course Goals

The goal of this course is to provide you with fundamental concepts, terms, and skills necessary to be conversant in the language and context found in computer science and other technology fields. This first course provides a foundation for the student to learn mathematical reasoning and algorithmic thinking, as well as be introduced to basic discrete structures such as sets and bit strings. The objectives at the beginning of each lesson provide specific outcomes you must aim for and achieve. After completing the lessons, you will understand the basic mathematical structures used in junior-level (and some sophomore-level) computer science courses.

Learning Outcomes

Upon successful completion of this course, students will:

- Construct mathematical arguments using logical connectives and quantifiers.
- Verify the correctness of an argument using propositional and predicate logic and truth tables.
- Perform operations on discrete structures such as sets, functions, relations, and sequences.
- Construct proofs using direct proofs, proofs by contraposition, proofs by contradiction, proofs by cases, and mathematical induction.
- Apply algorithms and use definitions to solve problems and prove statements in elementary number theory.
- Use graphs and trees as tools to visualize and simplify situations.

Course Materials

Discrete Mathematics and Its Applications, Kenneth. H. Rosen, McGraw-Hill, ISBN13: 9781259731259 with Connect. To access this electronic textbook, refer to the instructions in the Start Here module of this course.

A scientific calculator will be needed.

Assessments, Assignments, and Grading

Smartbook Reading Assignments (10%) Smartbook assignments are assigned to each reading assignment. You may attempt the Smartbook reading assignments as many times as you wish.

Homework (15%) Each module will have a homework assignment. You will be allowed **three** attempts.

Mid-term Exams (45%) There will be 2 mid-term exams. The exams will be 8 free response questions inspired by Smartbook Reading Assignments and Homework assignments.

Final Exam (30%) The final exam will be comprehensive and inspired by Smartbook Reading Assignments, Homework assignments, and previous exams.

You must wait at least one week between taking the mid-term exam and final exam.

Be sure to complete the *Course Pacing Guide* within two weeks of your course start date.

Students are not allowed to turn in more than one exam (mid-term or final) per week.

Students should submit assignments within the Canvas course site.

Grades

Final grades will be determined by your weighted average as follows:

- A: 90% - 100%
- B: 80% - 89%
- C: 70% - 79%
- D: 60% - 69%
- F: 0% - 59%

Numerical scores will be averaged up to the next integer.

You must score 60 percent or better on the final exam to pass the course.

Communication Policy

Faculty-student contact is important, even in correspondence courses. I encourage you to contact me if you have any concerns, questions, or problems. All e-mail should be handled through the Mail tool in Canvas. Responses to you should be returned within two business days.

Students Requiring Accommodation through the Office of Disability Services

Online & Extended Programs is committed to helping students with disabilities achieve their educational goals.

A disability is not a barrier to correspondence study, and we provide reasonable accommodations to individuals in coursework and test taking.

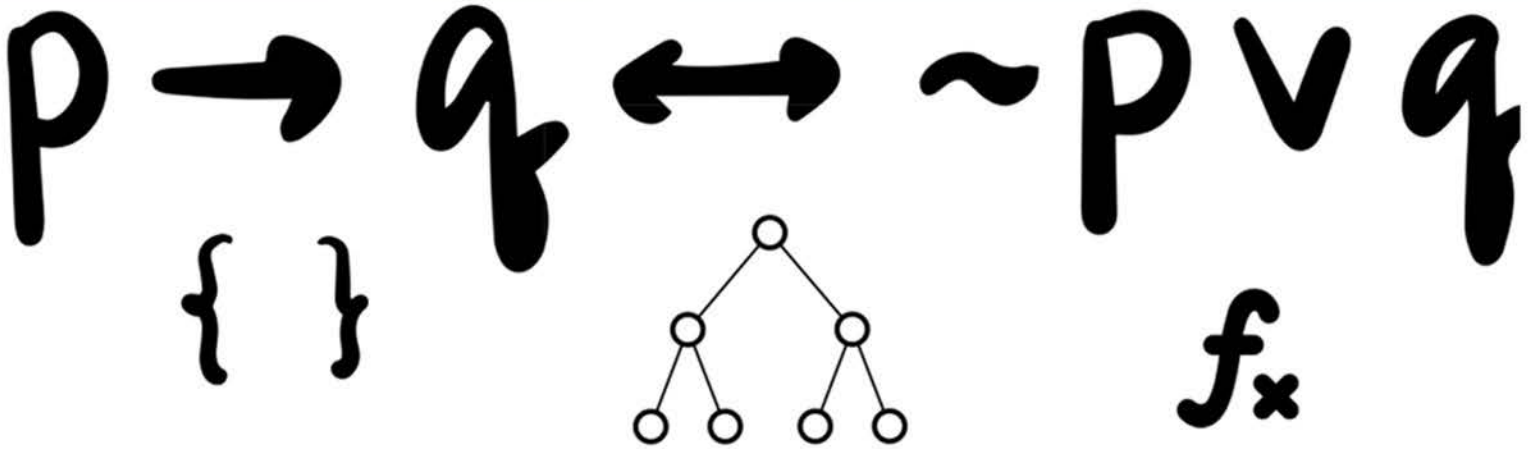
Students who require special accommodations need to provide verification of their disability to the [Office of Disability Services](#), Suite 5-5.1 LBJ Student Center, 512.245.3451 (voice/TTY).

Students should then notify Online & Extended Programs at corrstudy@txstate.edu of any disability-related accommodation needs as soon as possible to avoid a delay in accommodations.

Texas State Honor Code

The [Texas State Academic Honor Code](#) applies to all Texas State students, including correspondence students. The [Honor Code](#) serves as an affirmation that the University demands the highest standard of integrity in all actions related to the academic community. As stated in the [Texas State Student Handbook](#), [Violation of the Honor Code](#) includes, but is not limited to, cheating on an examination or other academic work, plagiarism, collusion, and the abuse of resource materials.

MATH 2358: DISCRETE MATHEMATICS 1

 Start Here Syllabus Modules Course Pacing Guide**Welcome to MATH 2358: Discrete Mathematics 1****Course Overview/Description**

This course is a study of discrete mathematical structures commonly encountered in computing hardware and software. Topics include logic, functions, elementary set theory, proof techniques, mathematical induction, numeric sequences, elementary number theory, and graph theory.

Course Instructor

Roberto Barrera

✉ Email: rbarrera@txstate.edu**Ready to begin?**

Click [Start Here](#) in the navigation bar above to begin your course.

Returning to this course?

Click [Modules](#) in the navigation bar above or in the left-hand course navigation and resume where you left off.

Questions about the course?

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To ensure timely delivery of all e-mails related to this course, you must use your official Texas State Bobcat Mail email address.

You may contact Online and Extended Programs using the email address provided.

✉ Email: corrstudy@txstate.edu

Overview



Introduction

The rules of propositional logic give precise meaning of mathematical statements and in understanding mathematical reasoning. The rules of propositional logic also have applications in the design of computer circuits, construction of computer programs, the verification of the correctness of programs, and more.

The aim of this module is to introduce the basic building blocks of propositional logic – propositions. Once we introduce the fundamental terminology of propositions, we define the operations used to form new propositions from existing propositions. We will apply the operators to simple English sentences as well as translate between English sentences and compound propositions. The definitions of the operators will be summarized using truth tables. Using the truth tables of the operators, we will understand how to construct truth tables of compound propositions.

With the ability to understand compound propositions, we introduce the notion of logical equivalence; that is, when two propositions are considered equivalent. We will use truth tables to determine whether two compound propositions are equivalent.

With propositions, logical operators, and logical equivalence assembled, we have developed the foundations of propositional logic.



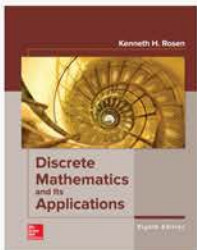
Objectives

Upon completion of this module, you will be able to:

1. Translate between logical connectives and English propositions. (CLO 1)
2. Understand truth tables of logical connectives. (CLO 1, 2)
3. Determine when two propositions are equivalent. (CLO 1, 2)



Readings



Discrete Mathematics and Its Application, McGraw-Hill, with Connect.

Authors: Kenneth. H. Rosen

ISBN 13: 978-1266818059

Chapters 1.1 - 1.3 (MLO 1, 2, 3)



Assignments

Connect Assignment: Propositional Logic (MLO 1, 2, 3)

Start Here

Meet Your Instructor

About Me



Hello, and welcome to Discrete Mathematics !! I am Dr. Roberto Barrera and I am excited to be with you throughout the course! This course is the study of discrete mathematical structures commonly encountered in computing hardware and software. Topics we will cover include logic, set theory, proof techniques, sums and sequences, elementary number theory, and graph theory. Along the way, we will see how some of these topics are applied to computer science. I am here to provide support to ensure your success in this course and in building a mathematical foundation for computer science. We can achieve this endeavor through communication and collaboration!

I have been at Texas State since 2017, where a majority of my teaching has been with the discrete mathematics course sequence. I earned my PhD in Mathematics from Texas A&M University in 2017 where my research has encountered various areas of discrete mathematics, including graph theory, discrete geometry, and combinatorics. Problems that especially interest me are in graph theory, computational and combinatorial algebra, and cake-cutting problems. I have published research papers and software in these areas. In my leisure time, you can likely find me at a skate park or speedrunning video games!

Contact Me

✉ Email: rbarrera@txstate.edu

Academic Integrity



Texas State Academic Honor Code

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As stated per [Texas State Honor Code, UPPS No. 07.10.01, Issue no. 8](#).

*Please note that not all activities that constitute academic misconduct are listed in specific detail in [UPPS No. 07.10.10, Honor Code](#). It is expected that students will honor the *spirit* of academic integrity and will not place themselves in the position of being charged with academic misconduct.

Please cite all unoriginal material through the use of [standard bibliographical practice](#) explained through the [Alkek library site](#).

Incidents of [academic dishonesty as outlined by the University](#) will be reported to the administration for disciplinary action. In addition, students will receive a 0 for the assignment or assignments without the opportunity to redo the work.



Definitions

Academic work signifies outcomes and products such as essays, theses, reports, exams, tests, quizzes, problems, assignments, or other projects submitted for purposes of achieving learning outcomes.

Cheating in general means, but is not limited to, engaging or attempting to engage in any of the following activities:

- Copying from another student's test paper, laboratory report, other report, computer files, data listing, programs, or from any electronic device or equipment;
- Using, during a test, materials not authorized by the person giving the test;
- Collaborating, without authorization, with another person during an examination or in preparing academic work;
- Knowingly, and without authorization, using, buying, selling, stealing, transporting, soliciting, copying, or possessing, in whole or in part, the content of an unadministered test;
- Substituting for another student—or permitting another person to substitute for oneself—in taking an exam or preparing academic work;
- Bribing another person to obtain an unadministered test or information about an unadministered test;
- Purchasing, or otherwise acquiring and submitting as one's own work, any research paper or other writing assignment prepared by an individual or firm. This section does not apply to the typing of the rough or final versions of an assignment by a professional typist;
- Submitting the same essay, thesis, report, or another project, without substantial revision or expansion of the work, in an attempt to obtain credit for work submitted in a previous course;
- Falsifying data.

Plagiarism in general means, but is not limited to, the appropriation of another's work and the inadequately or inappropriately acknowledged incorporation of that work in one's own written, oral, visual or the performance of an original act or routine that is offered for credit.

Collusion in general means, but is not limited to, the unauthorized collaboration with another person in preparing any work offered for credit.

Abuse of resource materials in general means, but is not limited to, the mutilation, destruction, concealment, theft or alteration of materials provided to assist students in the mastery of course content.

Correspondence Course Information

Important Reminders

- This is a **6-month**, online, correspondence self-paced course.
- **All submissions, including exams, must be completed by the course expiration date.** When you registered for the course, you were sent an email to your Texas State account indicating registration and expiration dates.
- You **may not submit** more than 2 assignments per week.
- You may not take an exam before previously submitted assignments have been graded and returned.
- At the end of the course, you will be asked to **complete a brief course evaluation.** Your input will help improve the course.



Orientation Video

Please view this orientation video to help you get started in this correspondence course. This video addresses many topics such as Bobcat Mail, navigating this course site, test requests, and more.



Correspondence Policies

As a correspondence studies student, it is your responsibility to be familiar with correspondence-related policies and services. To this end, I encourage you to review the [Correspondence Course Information page](#)  as well as the [Correspondence Studies website](#) .

Online Student Resources

[This webpage](#)  contains multiple resources for online students at Texas State University. Note: Some resources are only available to students who pay a student service fee.

Start Here

Free Tutoring Resources

A variety of [free tutoring resources](#) are available for students enrolled in Texas State correspondence courses.



Division of Student Success

Student Learning Assistance Center

Texas State / Division of Student Success / Student Learning Assistance Center / Tutoring

TUTORING

The STUDY

The STUDY offers tutoring provided by students specializing in business, science and math. Walk-in tutoring is available in the Alkek Library and Falls & Sayers residence hall or make an appointment for small group tutoring in Alkek. The STUDY is fee-funded so no additional cost is required.

[More about The STUDY](#)




Start Here

Students Requiring Accommodation Through the Office of Disability Services

The Office of Distance and Extended Learning is committed to helping students with disabilities achieve their educational goals.

A disability is not a barrier to correspondence study, and we provide reasonable accommodations to individuals in coursework and test taking.

Students who require special accommodations need to provide verification of their disability to the [Office of Disability Services](#), Suite 5-5.1 LBJ Student Center, 512.245.3451 (voice/TTY).

Students should then notify the [Online and Extended Programs](#)  at corrstudy@txstate.edu of any disability-related accommodation needs as soon as possible to avoid a delay in accommodations.

TXST Accessibility Policy Statement

[Texas State University Statement on Accessibility](#) 

Vendor Accessibility Statements

The following statements are available to learn more about the accessibility of tools used in this course:

- [Canvas](#)
- [Yuja](#)
- [McGraw-Hill](#) 

Course Syllabus

You will find your syllabus for the course posted here:

[Syllabus](#) ↓

Be sure to download a copy and add important due dates to your planner or calendars!

Institutional Policies & Procedures

Texas State University Honor Code


As members of a community dedicated to learning, inquiry, and creation, the students, faculty, and administration of our university live by the principles in this Honor Code (see [Honor Code, UPPS No.07.10.01](#) ↗). These principles require all members of this community to be conscientious, respectful, and honest.

- **We Are Conscientious.** We complete our work on time and make every effort to do it right. We come to class and meetings prepared and are willing to demonstrate it. We hold ourselves to doing what is required, embrace rigor, and shun mediocrity, special requests, and excuses.
- **We Are Respectful.** We act civilly toward one another and we cooperate with each other. We will strive to create an environment in which people respect and listen to one another, speaking when appropriate, and permitting other people to participate and express their views.
- **We Are Honest.** We do our own work and are honest with one another in all matters. We understand how various acts of dishonesty, like plagiarizing, falsifying data, and giving or receiving assistance to which one is not entitled, conflict as much with academic achievement as with the values of honesty and integrity.

Addressing Acts of Dishonesty

Students accused of dishonest conduct may have their cases heard by the faculty member. The student may also appeal the faculty member's decision to the Honor Code Council. Students and faculty will have the option of having an advocate present to ensure their rights. Possible actions that may be taken range from exoneration to expulsion.

Students with Disabilities

In accordance with university policy and federal law, all members of the university community are responsible for ensuring that students are not discriminated against because of a disability. To accomplish this goal, reasonable and appropriate academic accommodations may be necessary for qualified students with disabilities. The [Office of Disability Services](#)  will coordinate with faculty members to facilitate necessary accommodations for students with disabilities.

If you are a student with a disability who will require an accommodation to participate in this course, please contact your instructor as soon as possible. You will be asked to provide documentation from the Office of Disability Services. Failure to contact your instructor in a timely manner may delay your accommodations





Mental Health

















Mental health issues can diminish academic performance and may affect students' ability to participate in activities. The Counseling Center at Texas State provides free and confidential mental health services on both its San Marcos and Round Rock campuses. For additional information, visit the Counseling Center's [website](#) or call 512.245.2208. Additional resources are available on the university website "[Minds Matter](#)."

Additional Student Resources

Learn more about additional [Student Resources](#)  available to you as a Texas State University student.

Course Summary:

Date	Details	Due
	 Chapter 1.1 Smartbook Assignment	due by 11:59pm
	 Chapter 1.3 Smartbook Assignment	due by 11:59pm
	 Chapter 1.4 Smartbook Assignment	due by 11:59pm
	 Chapter 1.5 Smartbook Assignment	due by 11:59pm

 Chapter 1.7 Smartbook Assignment	due by 11:59pm
 Chapter 1.8 Smartbook Assignment	due by 11:59pm
 Chapter 10.1 Smartbook Assignment	due by 11:59pm
 Chapter 10.2 Smartbook Assignment	due by 11:59pm
 Chapter 10.3 Smartbook Assignment	due by 11:59pm
 Chapter 10.4 Smartbook Assignment	due by 11:59pm
 Chapter 10.5 Smartbook Assignment	due by 11:59pm
 Chapter 10.6 Smartbook Assignment	due by 11:59pm
 Chapter 11.1 Smartbook Assignment	due by 11:59pm
 Chapter 11.4 Smartbook Assignment	due by 11:59pm
 Chapter 11.5 Smartbook Assignment	due by 11:59pm
 Chapter 2.1 Smartbook Assignment	due by 11:59pm
 Chapter 2.2 Smartbook Assignment	due by 11:59pm
 Chapter 2.3 Smartbook Assignment	due by 11:59pm
 Chapter 2.4 Smartbook Assignment	due by 11:59pm
 Chapter 4.1 Smartbook Assignment	due by 11:59pm
 Chapter 4.2 Smartbook Assignment	due by 11:59pm

Canvas LMS

 Chapter 4.3 Smartbook Assignment due by 11:59pm

 Chapter 4.4 Smartbook Assignment due by 11:59pm

 Chapter 5.1 Smartbook Assignment due by 11:59pm

 Chapter 5.2 Smartbook Assignment due by 11:59pm

 Course Pacing Guide Submission

 Exam 1

 Exam 2

 Final Assessment

 Final Exam Proctored

 M1: Assignment

 M1: Quiz

 Module 1 Assignment

 Module 10 Assignment

 Module 11 Assignment

 Module 12 Assignment

 Module 13 Assignment

 Module 14 Assignment

 Module 15 Assignment

 Module 16 Assignment

 Module 2 Assignment

 Module 3 Assignment

 [Module 4 Assignment](#)

 [Module 5 Assignment](#)

 [Module 6 Assignment](#)

 [Module 7 Assignment](#)

 [Module 8 Assignmnet](#)

 [Module 9 Assignment](#)

Start Here

Technical Requirements and Support



Technical Requirements

This online course requires technical skills and access to certain technology and software that face-to-face courses may not require.

- Learn about [skills and technology](#) you need to be successful in this course.
- Also review these [tips](#) and [interaction guidelines](#) to be a successful online learner.

Many users encounter fewer problems when they use [Chrome](#) to access Canvas courses.

The textbook used in this course utilizes McGraw Hill Connect. Please go to the [How to Use McGraw Hill Connect](#) page to learn more.



Technical Support

Here's how to get help with Canvas:

- 24/7 [Live chat](#)
- 24/7 Phone support: 245.ITAC (4822)
- [Tool-specific help](#)
- Click Help in the left navigation of any Canvas course

Tips for Success



Succeed in this Course

If you have not done so already, be sure to familiarize yourself with the [Syllabus](#) and review all the information very carefully.

To succeed in this course, please fill out your Course Pacing Guide and take no more than 2 weeks from when you enroll to submit it via the Start Here Module.

More Tips for Success

1. **Establish a study routine:** Set a consistent schedule for studying and completing coursework. Treat it like a regular class and allocate dedicated time each day or week to focus on your online course.
2. **Create a conducive study environment:** Designate a quiet and comfortable space for studying where you can minimize distractions. Ensure you have a reliable internet connection and access to necessary course materials.
3. **Be thorough:** Carefully read the information related to your mid-course and final exams (if you have them).
4. **Stay organized:** Keep track of important deadlines, assignments, and course materials. Use digital or physical tools such as calendars, and to-do lists to stay organized and avoid falling behind. The Canvas calendar and to-do list on your dashboard are great tools to utilize for this!
5. **Ask for help!** Contact your instructor if you have any questions or concerns. Remember, you can also use the free tutoring resources that have been provided to you through Texas State University.
6. **Manage your time effectively:** Develop time management skills to balance your online course with other responsibilities. Break down larger assignments into smaller tasks, set deadlines for yourself, and prioritize your coursework to ensure timely completion.
7. **Take advantage of resources:** Explore the available resources offered by your online course, such as lecture materials, supplementary readings, or online tutorials. Utilize them to enhance your understanding and reinforce your learning.
8. **Stay motivated and self-disciplined:** Online correspondence courses require self-motivation and discipline. Stay motivated by setting achievable goals, celebrating small victories, and reminding yourself of the benefits and value of completing the course.
9. **Practice self-care:** Take care of your overall well-being while engaging in online learning. Prioritize self-care activities such as exercise, breaks, healthy eating, and adequate sleep. Maintaining a healthy balance will help you stay focused, energized, and motivated throughout the course.

Remember, success in online correspondence courses requires self-discipline, active engagement, and effective time management. By implementing these tips, you can maximize your learning experience and thrive in your online course.

Overview



Introduction

The rules of propositional logic give precise meaning of mathematical statements and in understanding mathematical reasoning. The rules of propositional logic also have applications in the design of computer circuits, construction of computer programs, the verification of the correctness of programs, and more.

The aim of this module is to introduce the basic building blocks of propositional logic – propositions. Once we introduce the fundamental terminology of propositions, we define the operations used to form new propositions from existing propositions. We will apply the operators to simple English sentences as well as translate between English sentences and compound propositions. The definitions of the operators will be summarized using truth tables. Using the truth tables of the operators, we will understand how to construct truth tables of compound propositions.

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With propositions, logical operators, and logical equivalence assembled, we have developed the foundations of propositional logic.



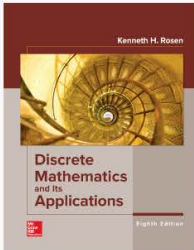
Objectives

Upon completion of this module, you will be able to:

1. Translate between logical connectives and English propositions. (CLO 1)
2. Understand truth tables of logical connectives. (CLO 1, 2)
3. Determine when two propositions are equivalent. (CLO 1, 2)



Readings



Discrete Mathematics and Its Application, McGraw-Hill, with Connect.

Authors: Kenneth. H. Rosen

ISBN 13: 978-1266818059

Chapters 1.1 - 1.3 (MLO 1, 2, 3)



Assignments

Connect Assignment: Propositional Logic (MLO 1, 2, 3)

Module 1

1.1: Propositions



Reading

Read Chapter 1.1. The truth tables of the logical operators must be known to construct truth tables of compound propositions. After reading through 1.1.4, the following video gives an example of constructing a truth table of a compound proposition.



Video

Truth Table of Compound Proposition

This video illustrates an example of finding the truth table of a compound proposition. Observe the order of operations is determined by the parentheses, with negations acting on propositions directly next to them.

Truth tables of compound propositions

Recall:

p	$\neg p$	$p \wedge q$	$p \vee q$	$p \vee \neg q$
T	F	T	T	T
F	T	F	T	T
T	F	F	F	F
F	T	F	T	T

p	q	$p \Rightarrow q$	$p \Leftrightarrow q$	$p \oplus q$
T	T	T	T	F
T	F	F	F	T
F	T	T	F	T
F	F	T	T	F

eg. Truth table of $(p \vee \neg q) \Rightarrow q$:

1.1 Smart Book Assignment Overview



Instructions

Please read Chapter 1.1: Propositional Logic prior to beginning the assignment. You may exclude 1.1.6: Logic and Bit Operations. If you are having trouble with a question, press "Reading" to see the relevant subsection in the textbook.

- Make progress by completing concepts. The number of questions will vary depending on your individual needs.
- It's okay to get questions wrong. You still earn 100% if you complete all concepts by your due date.
- Submit your answers by selecting your confidence level. This will not affect your grade.