MATH 3340: Foundations of Higher Math

Sul Ross State University
Spring 2023

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Course Description	Organization and structure of mathematical thought. Writing and evaluating proofs. Topics include propositional logic, set theory, functions, sequences, relations, number theory, and graph theory.
Mathematics Program Outcomes	(1) The student will be able to demonstrate content knowledge of basic mathematical principles. (2) The student will be proficient in logic, able to negate statements, provide counterexamples to false statements, and determine the validity of arguments. (3) The student will be able to communicate mathematical content clearly and with valid reasoning.
Marketable Skills	(1) Logical and analytical skills. (2) Problem-solving using analytic and algebraic methods. (3) Use of technology in problem-solving and presentation. (4) Communication and pedagogical skills.
Class Meetings	Monday and Wednesday, 4:30 – 5:45
Class Location	Del Rio 103; Eagle Pass B113; Uvalde B108; Alpine ACR 206.
Required Texts	There are no required texts. All necessary material will be provided in the lecture. If you would like a textbook as an additional resource, I recommend Susanna Epp's *Discrete Mathematics*.

Course Policies

Attendance Policy

Attendance is mandatory. Students are expected to attend class in person in their classroom of registration unless permission is given for extenuating circumstances. You will be held responsible for all material covered in class or in the reading assignments. If you have to miss a class, it is your responsibility to obtain all notes, assignments, and announcements from someone else in the class. Make-up exams will be given only in the event of an emergency, in which case written justification and/or documentation must be provided and approved.

Communication

The Blackboard system will be used to provide course materials, submit assignments, and post grades. You are welcome to e-mail, call, or text me at any time. My cell number is **(830) 333-0164**. Please identify yourself in your text or voicemail. Please make sure to check the e-mail address associated with Blackboard on a regular basis.

Grading Policy

Your grades will be weighted as follows:

Participation	10%
Homework	40%
Midterm Exam	20%
Final Exam	30%

A student who averages at least 90% will receive an A; at least 80% will receive at least a B; at least 70% will receive at least a C; at least 60% will receive at least a D.

Participation

Your participation grade will be assigned depending on your class attendance and participation in class activities. Simply put, if you always come to class, seem like you're trying to pay attention and take notes, and take part in class activities, then you will get full credit. If attending remotely as necessitated by university policy under pandemic restrictions, participation includes having your webcam on.

Homework

For each section you will be asked to complete an assignment. Assignments will be made available on Blackboard. Homework can be submitted in a variety of formats, but each assignment must be submitted as a single file that I can view and grade on Blackboard.

One possibility would be to type up your homework using the Equation Editor on Microsoft Word and save it as a PDF. Another would be to capture high-quality images of your homework using a phone or other device and combine into a single file, e.g. by pasting each image into a word processor file. Feedback will be provided in the form of comments your Blackboard file.

All work must be shown for full credit. Try to be as tidy as possible so that I can understand your work. I'm flexible as to file format provided I can view your submission on Blackboard. Submissions consisting of multiple image files will not be graded as it's too easy for me to lose my place and miss something. If I have trouble seeing your file, I will let you know and give you a chance to resubmit.

Each problem will be worth 4 points unless otherwise noted.

ALWAYS TURN IN THE HOMEWORK, EVEN IF IT'S INCOMPLETE.

YOU WILL NOT PASS THE CLASS IF YOU DON'T SUBMIT HOMEWORK.

I'm flexible about due dates if something comes up, but unexcused late work may receive a zero.

Feedback will be provided in the form of notes on your submitted file. It is your responsibility to carefully view all feedback and contact me if you have any questions or concerns.

Exams

There will be one midterm exam. Its tentative date is Wednesday, March 8. This is subject to change. You will be notified of a change at least one week in advance. Make-up exams will be given only in the event of an emergency, in which case written justification and/or documentation

must be provided and approved.

The final exam will take place at the time scheduled by the university. The final exam will be comprehensive.

Subject Outline

Below is a tentative outline of the subjects we will cover in this course.

I. Formal Logic
   1. Statements and Logical Equivalence: *statements – negation – conjunction – disjunction – equivalence – De Morgan's laws – distributive laws*
   2. Conditional Statements: *conditional statements – negating conditionals – the contrapositive, the converse, and the inverse – biconditional statements*
   3. Valid and Invalid Arguments: *syllogisms – validity – modus ponens – modus tollens – the transitive rule – other rules of inference – arguments*
   4. Quantified Statements: *universal and existential quantifiers – negating statements with quantifiers*

II. Set Theory
   1. Sets: *notation – set relations – set operations – Venn diagrams – the power set – limitations of set theory*
   2. Properties of Sets: *relation to formal logic – proofs concerning set inclusion – the transitive property – proofs concerning set equality – properties of set operations – Boolean algebra and computer science*
   3. Relations: *Cartesian products – relations and diagrams – equivalence relations – basic examples*
   4. Functions: *functions and relations – graphs and diagrams – composition – onto and one-to-one functions – bijection*
   5. Cardinality: *equivalence of sets – cardinality – countability – Cantor's theory of infinite sets*

III. Number Theory
   1. The Natural Number System: *the natural numbers – the Peano axioms – arithmetic sequences – geometric sequences – recursive sequences – the Fibonacci sequence – triangular numbers*
   2. Mathematical Induction
   3. Divisibility: *the integers – divisibility and divisors – the division algorithm – long division – the greatest common divisor – the Euclidean Algorithm*

4. The Fundamental Theorem of Arithmetic: *primes and composites – the Fundamental Theorem – prime factorizations – the Sieve of Eratosthenes – primality tests*

IV. Graph Theory

1. Introduction to Graphs: *the Seven Bridges of Königsberg – graphs – traveling salesmen and highway inspectors – Euler paths and Euler circuits – Hamilton paths – the Icosian Game*
2. Euler's Theorem: *simple graphs – complete graphs – bipartite graphs – the Three Utilities – planar graphs – Euler's Theorem – Kuratowski's Theorem – polyhedra*
3. Coloring Graphs: *graph-coloring – the chromatic number – logic puzzles – maps – the Four Color Theorem*

Schedule

This schedule is tentative only. The section numbers refer to the outline above.

Unit I	January 18 – February 13
Unit II	February 13 – March 6
Midterm Exam	**March 8**
Spring Break	*March 3 – 17*
Unit III	March 20 – April 19
Unit IV	April 19 – May 10
Final Exam	**TBA**

University Statements

Distance Education Statement: *Students enrolled in distance education courses have equal access to the university's academic support services, such as library resources, online databases, and instructional technology support. For more information about accessing these resources, visit the SRSU website. Students should correspond using Sul Ross email accounts and submit online assignments through Blackboard, which requires secure login. Students enrolled in distance education courses at Sul Ross are expected to adhere to all policies pertaining to academic honesty and appropriate student conduct, as described in the student handbook. Students in web-based courses must maintain appropriate equipment and software, according to the needs and requirements of the course, as outlined on the SRSU website. Directions for filing a student complaint are located in the student handbook.*

SRSU Disabilities Services: *Sul Ross State University (SRSU) is committed to equal access in compliance with Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the student's responsibility to initiate a request each semester for each class. RGC students seeking accessibility services should contact Paulette Harris, Executive Assistant to the Vice President and Dean, at 830-279-3023 or*

email pharris@sulross.edu. Ms. Harris's office is at 2623 Garner Field Road, Uvalde, TX 78801 (this is the mailing address, too).

University Libraries: *The Sul Ross Library offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library's website, library.sulross.edu. SRSU RGC students may request InterLibrary Loans (ILLs) and book check outs from the Sul Ross Library to be picked up at the SWTJC library that is most convenient. Access requires your LoboID and password. Librarians are a tremendous resource for your coursework and can be reached in person, by email (srsulibrary@sulross.edu), or phone (432-837-8123).*

The Southwest Texas Junior College (SWTJC) Library is also available on each campus for your physical use of the space or checking out books. Del Rio, Eagle Pass, and Uvalde students may use online resources available through SWTJC website, library.swtjc.edu. These libraries serve as pickup locations for your ILL or Document Delivery or book requests; to do so, choose the appropriate pick-up location when requesting materials from the Alpine campus.