MATH 3300: Introduction to Proofs

Section 001 – Fall 2013

Time: MWF 9:00—9:50 AM
Classroom: Pickard Hall 109
Instructor: Prof. Barbara Shipman
Office: Pickard Hall 437
Phone: (817) 272-2606
E-mail: bshipman@uta.edu
Office Hours: Monday, Tuesday, Wednesday 10:30—11:30 AM
Website: www.uta.edu/faculty/shipman at Student Center, Math 3300

Prerequisite: Math major or math intended major. B or better in MATH 1426 or HONR-SC 1426; OR C or better in MATH 2425 or HONR-SC 2425.

Textbook (required)**:** Foundations of Mathematics, by Thomas Q. Sibley.
ISBN: 978-0-470-08501-1

Learning Outcomes: On successful completion of this course, students will be able to

- think critically about mathematical statements using sound principles of logic,
- give clear explanations of solutions and reasoning, both orally and in writing,
- read and understand mathematical writing at the level of the textbook,
- decide whether statements involving the topics of the course are true or false,
- construct correct mathematical arguments to prove their claims about statements on the topics of the course,
- create examples or counter-examples and apply them appropriately to prove or disprove statements about the topics of the course, and
- be confident about the correctness of their mathematical reasoning and proofs.

Course Content: Techniques for constructing proofs for various propositions. The propositions chosen exhibit properties of functions, relations, sets, cardinality, and other ideas in mathematics. An axiomatic approach to some areas in mathematics. Oral presentations of proofs are required.

Expectations of the Student:

- **Attendance policy:** You are expected to attend every class, arrive on time, and remain in class for the whole period.
- **Participation:** You are expected to bring all assigned study problems well prepared to every class and to participate fully in oral presentations and class activities.
- **15 hours per week outside of class.** You are expected to spend at least 15 hours per week outside of class studying and (re-)working problems for this course.
- **Course notebook.** You are expected to keep a neat, up-to-date, and organized binder with correct solutions to all problems assigned or discussed in class.
- **MavMail and Announcements:** You must have an activated MavMail account and check it regularly. You are responsible for all information that I send to your MavMail account and all announcements that I make in class or on the course website: go to the Student Center, Math 5307 at www.uta.edu/faculty/shipman .
- **Asking for help when needed.** You are expected to attend every class and then ask for help on material that you may not be grasping fully. You may work with your classmates, come to office hours, or send me an e-mail with specific question(s).
- **Personal responsibility.** The ultimate responsibility for your learning lies with you. The onus is on you to attend every class, keep up daily with the assignments, put in the expected hours, keep your course notebook up-to-date, and ask for help when needed.

Study Problems and Oral Participation: Study problems will be assigned daily as posted on the course website. During every class, you must be prepared to hand in or give an oral explanation of your solution to any study problem previously assigned; you may also be asked to explain your reasoning to other questions that arise during class discussions. Study problems may or may not be collected; they will be discussed as time permits. You are expected to work out correct solutions to all study problems, resolve any questions that you have on them, keep your correct solutions organized in your class binder, and bring this binder to every class. Study problems must be prepared as follows:

- In the top left corner of every page, write your name and the date of the assignment.
- Number each study problem as given in the assignment.
- For each problem, write out the complete question before presenting your solution.
- Write neatly and large and dark enough for good legibility. You may type your work.
- Explain all your answers and justify all claims in your proofs.

Scoring for Prepared Attendance with Oral Participation: At every class, you will receive an attendance and oral participation score according the following scheme:

- 2, for being present during the entire period with good participation and preparation.
- 0—1, if you are not present during the entire period or are inadequately prepared. If you arrive late, your score will be recorded as 0; if you would like me to consider raising this to 1, inform me *after class on the same day*.
- 0, for missing class for any reason.

Quizzes: Zero to three short quizzes will be given each week; these will take the place of longer midterm exams and will provide you with frequent feedback on your progress. Quizzes are cumulative and may cover any study problems, material, or readings assigned or discussed up to that point. You are expected to come to every class prepared for a possible quiz; the dates of the quizzes will be unannounced. A missed quiz cannot be made up for any reason. Out of a total of N quizzes, M lowest quiz scores will be dropped, where M is the smallest integer greater than or equal to N/7. (That is, to get M, take N/7 and round up to the nearest integer.) Here are some tips on preparing for the quizzes:

- Regularly review all class notes and study problems.
- Re-work study problems and problems discussed in class without resorting to notes. Consult notes only after a solid effort to re-work the problems on your own.
- Set aside ample time to work out all study problems carefully before the next class.
- Form study groups with classmates and work on coursework together.
- Pinpoint the specific question if you “get stuck” on a problem. Often in seeking to identify the question, one will see how to solve it.
- Meet with the instructor to settle remaining questions that you may have.

Final Exam: There will be a comprehensive final exam on Wed. Dec. 11 from 8:00--10:30 AM, in the same room as the class. A missed final exam cannot be made up.

Grading: Your work will be graded on correctness, completeness, and clarity.

Prepared Attendance with Oral Participation:	15%
Quiz Average:	45%
Final Exam:	40%
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Course average	100%

Your course average determines your final grade. A: 90—100%; B: 80—89%; C: 70—79%; D: 60—69%; F: 0—59%. Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

Course Schedule: *The day-by-day outline is approximate; the instructor may adjust this schedule in any way that better serves the educational needs of the students enrolled in this course.*

Week 1	Aug 23	Mathematical propositions and predicates; simple existence proofs
Week 2	Aug 26	Propositional forms and truth tables
	Aug 28	Logical equivalence, working negations; DeMorgan's laws
	Aug 30	Tautologies, contradictions; implications and their working negations
Week 3	Sep 2	Labor Day; no class
	Sep 4	Negation of implication with universal quantifiers; proof by counterex.
	Sep 6	Converse and contrapositive; proof by contrapositive
Week 4	Sep 9	Alternate language for implications; Existential, universal quantification
	Sep 11	Negating statements with quantifiers
	Sep 13	Proving propositions involving existential and universal quantifiers
Week 5	Sep 16	Proving propositions with both existential and universal quantifiers
	Sep 18	Proving propositions with existential and universal quantifiers
	Sep 20	More proofs involving both existential and universal quantifiers
Week 6	Sep 23	Introduction to set theoretic definitions and concepts
	Sep 25	More on Venn diagrams; DeMorgan's laws in the context of set theory
	Sep 27	2-column proofs involving set theoretic distributivity and DeMorgan's laws
Week 7	Sep 30	More on 2-column proof techniques involving set theoretic concepts
	Oct 2	Practice with 2-column proofs involving set theoretic concepts
	Oct 4	Proof by counterexample in more detail
Week 8	Oct 7	Introduction to number theory – division, primes, gcd, even/odd numbers
	Oct 9	Problems and proofs involving basic concepts of number theory
	Oct 11	More proofs involving basic concepts of number theory
Week 9	Oct 14	Additional practice with direct proof
	Oct 16	Proofs involving derivations
	Oct 18	Proofs of "if and only if" statements
Week 10	Oct 21	More practice with derivations and "if and only if" proofs
	Oct 23	Proof by contrapositive
	Oct 25	Proof by contrapositive and proof by contradiction
Week 11	Oct 28	More practice with proof by contrapositive and proof by contradiction
	Oct 30	Practice: proof by contrapositive/contradiction; Last day to drop a class
	Nov 1	Proofs involving existence and uniqueness
Week 12	Nov 4	Proofs involving existence and uniqueness; proofs involving cases
	Nov 6	Proofs with "or" in the hypothesis; proofs with cases
	Nov 8	Proofs with "or" in the conclusion
Week 13	Nov 11	Proofs involving cases and "or" in the hypothesis or conclusion
	Nov 13	The principle of mathematical induction; proof by mathematical induction
	Nov 15	Proof by mathematical induction; variations of the principle of induction
Week 14	Nov 18	Proving summation formulas by mathematical induction
	Nov 20	Definitions of function, injective and surjective functions
	Nov 22	Analyzing and proving statements involving functions
Week 15	Nov 25	More practice analyzing and proving statements involving functions
	Nov 27	Injective and surjective functions in relation to composition of functions
	Nov 29	Thanksgiving break; no class
Week 16	Dec 2	Proofs on injective and surjective functions and composition
	Dec 4	More proofs involving functions; more general relations
Finals	Dec 11	Final Exam 8—10:30 AM (Wednesday)

Policies of the University of Texas at Arlington:

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. Students will not be automatically dropped for non-attendance**.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/ses/fao).

Americans with Disabilities Act: The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Academic Integrity: All students enrolled in this course are expected to adhere to the UT Arlington Honor Code:
I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

Instructors may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory shall be directed to complete a Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit http://www.uta.edu/sfs.

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. During this week, classes are held as scheduled, and instructors may introduce new concepts as appropriate. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; instructors may give assignments that have a completion date during or following this week *only if specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except make-up tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week.

Student Disruption: The University reserves the right to impose disciplinary action for an infraction of University policies. This includes engagement in conduct, alone or with others, that obstructs, disrupts, or interferes with any function of class activities.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located at the northeast corner of Pickard Hall; exit the classroom and turn right. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.