MATH 3350-01 (**Introduction to Mathematical Proofs**)

Syllabus for Fall 2018

**Classroom**: EMAGC 1.212

**Time:** Mondays & Wednesdays 10:50am - 12:05pm

**Instructor:**

Dr. Zhijun (George) Qiao

Office: MAGC 3.722, Phone: 665-3406 (W), Email: zhijun.qiao@utrgv.edu

Webpage: <http://faculty.utrgv.edu/zhijun.qiao> (**Online notes are available** at Dr. Qiao’s website)

**Office hours**: MW 1:00pm – 2:30pm or by appointment.

**Prerequisite**: MATH 1460 (Calculus 1) with a grade of “C” or better.

**Required Textbook:** *Mathematical Proofs: A Transition to Advanced Mathematics,* 3rd or 4th ed., by Gary Chartrand, Albert D. Polimeni, and Ping Zhang, Pearson Education, Inc., 2013 or 2018.

**Calculators and Other Electronic Equipment**: A scientific or graphing calculator will be needed on occasion. Selected assignments will be typed, so you will need access to a computer and software that will render mathematical formulas, such as Microsoft Word with the Equation Editor or MathType installed.

**Daily supplies:**  You need to bring Textbook, Notebook, Loose leaf paper, Graph paper, Pen, Pencil etc to the class.

**Objective:** This course is intended to prepare the student for advanced mathematics courses that require the writing of proofs. It reviews the elementary proof methods and the logical structure underlying them. It examines the formal definitions and basic properties of the mathematical structures that one encounters when constructing proofs, and it recounts famous theorems concerning these structures that every mathematician needs to know. Students are expected to construct, independently, non-routine mathematical proofs and to present their work in written form. Substantial written work is required.

**Course Student Learning Objectives**: By the end of this course, a successful student will be able to

1. Understand the logical structure of mathematical proofs and associated constructs, such as logical statements, conditional statements, and quantified statements.
2. Master the basic techniques and strategies used in mathematical proofs, such as direct proof of conditional and quantified statements, proof by contrapositive, proof by contraction, proof by exhaustion, uniqueness proofs, and mathematical induction.
3. Master the basic techniques used to disprove false conjectures.
4. Write mathematical arguments, such as proofs, in clear, precise, and correct English.
5. Master rudimentary mathematical typesetting.
6. Understand and use correctly mathematical structures and tools such as sets, relations, orders, functions, and cardinality, as well as often used formulas and inequalities.
7. Develop an expanding vocabulary of mathematical terminology and the ability to use it fluently and correctly.
8. Become acquainted with famous mathematical ideas, theorems, arguments, proofs, and formulas that every mathematician should know.

**Topics:** The main part of the course will be the development of proof techniques and mathematical writing from Chapters 0-7 of the textbook. Selected sections from Chapters 8-11 will be used to illustrate and practice these proof writing techniques.

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| **0. Communicating Mathematics**Learning MathematicsWhat Others Have Said About WritingMathematical WritingUsing SymbolsWriting Mathematical ExpressionsCommon Words and Phrases in MathematicsSome Closing Comments about Writing | **6. Mathematical Induction**6.1 The Principle of Mathematical Induction6.2 A More General Principle of Mathematical Induction |
| **1. Sets**1.1 Describing a Set1.2 Subsets1.3 Set Operations1.4 Indexed Collections of Sets | **7. Prove or Disprove**7.1 Conjectures in Mathematics7.2 Revisiting Quantified Statements7.3 Testing Statements |
| **2. Logic**2.1 Statements2.2 The Negation of a Statement2.3 The Disjunction and Conjunction of Statements2.4 The Implication2.5 More on Implications2.6 The Biconditional2.7 Tautologies and Contradictions2.8 Logical Equivalence2.9 Some Fundamental Properties of Logical Equivalence2.10 Quantified Statements2.11 Characterizations of Statements | **8. Equivalence Relations**8.1 Relations8.2 Properties of Relations8.3 Equivalence Relations8.4 Properties of Equivalence Classes8.5 Congruence Modulo n |
| **3. Direct Proof and Proof by Contrapositive**3.1 Trivial and Vacuous Proofs3.2 Direct Proofs3.3 Proof by Contrapositive3.4 Proof by Cases | **9. Functions**9.1 The Definition of Function9.2 Set of Fcns from A to B 9.3 1-1 & Onto Fcns9.4 Bijective Fcns 9.5 Composition of Fcns 9.6 Inverse Fcns |
| **4. More on Direct Proof and Proof by Contrapositive**4.1 Proofs Involving Divisibility of Integers4.2 Proofs Involving Congruence of Integers4.3 Proofs Involving Real Numbers4.4 Proofs Involving Sets4.5 Fundamental Properties of Set Operations4.6 Proofs Involving Cartesian Products of Sets |  |
| **5. Existence and Proof by Contradiction**5.1 Counterexamples 5.2 Proof by Contradiction5.3 A Review of Three Proof Techniques5.4 Existence Proofs5.5 Disproving Existence Statements |  |

**Program Learning Outcomes**: Students completing the B.S. program in Mathematics will:

1. Demonstrate in-depth knowledge of Mathematics, its scope, application, history, problems, methods, and usefulness to mankind both as a science and as an intellectual discipline.
2. Demonstrate a sound conceptual understanding of Mathematics through the construction of mathematically rigorous and logically correct proofs.
3. Identify, formulate, and analyze real world problems with statistical or mathematical techniques.
4. Utilize technology as an effective tool in investigating, understanding, and applying mathematics.
5. Communicate mathematics effectively to mathematical and non-mathematical audiences in oral, written, and multi-media form.
6. Demonstrate an appreciation of and enthusiasm for lifelong scientific inquiry, learning, and creativity.

**General Grade Policy**

**Quizzes and Homework –** Homework assignment be issued on a regular basis and will consist of problems from the WeBWork, textbook and occasional handout. In general, all homework problems are assigned through WeBWork. Quizzes and Tests are based on the homework problems. A quiz will be taken every week. It is strongly recommended that students work all those homework problems since quiz and test score are used to determine your grade. Completing the assignments is the ***single most important part*** of this course. You will be expected to spend, on average, about 3 hours each week to complete the assignments. You are allowed to work in groups to complete the homework, but the quiz paper must be finished solely by you. Any type of academic dishonesty will be handled by the instructor or by the appropriate administration. A homework assignment sheet will be delivered to everybody on the 1st day class. No late re-quiz will be accepted.

**Tests –** there will be three one-hour in-class tests. All tests must be taken during their scheduled times. The test time will be announced in advance (basically, a test will be given monthly), and a short review will be given before each test. All students must show their work on the tests. Score will be provided to you separately. No retest opportunities.

**Final Exam –** The comprehensive final exam is tentatively scheduled on December 10 (M), 2018, 10:15am – 12:00pm. All students must take the final exam at the scheduled time. A summary review will be given in the class before the final exam.

**Grading –** The course grade will be based on

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| Best 10 of the weekly quiz/HW at 10 pts each | 100 pts  |
| Test 1  | 100 pts |
| Test 2  | 100 pts |
| Test 3  | 100 pts |
| Comprehensive Final Exam | 100 pts |
| Total | 500 pts |

The course grade will be assigned according to a scale no higher than A(90-100%), B(80-89%), C(70-79%), D(60-69%), F(below 60%).

**THERE WILL BE NO MAKE-UP QUIZZES OR EXAMS GIVEN**.

If a student is absent during a scheduled major test and quiz, the student must go by the instructor’s office during the scheduled office hours to discuss the validity of the excuse.  In the case of a valid excuse, the missed test grade will be replaced by the final exam grade.    If a student does not have a valid excuse, the grade for the missed test is a zero and cannot be replaced.  If you arrive late to a test you will not be given additional time to complete the exam.  Anyone arriving to a test after somebody else who took the exam has left will not be allowed to take the exam. Students missing more than one exam may be dropped from the course. With an unexcused absence, a score of 0 will be recorded for the missed HW/Quiz or exam.

**Tutoring:** There are several tutoring places available on campus. Math Lab, EMAGC 1.106 and the Math Learning Center in the LEAC Building.

***Classroom Behavior:***

* All beepers and cellular phones must be turned off before you enter the classroom.
* Once in class, a student is expected to remain in class for the duration of the class.  If a student needs to leave class early, than the student needs to discuss the situation with the instructor before class begins.
* During class students are expected to be courteous to the instructor and other classmates. Examples of discourteous behavior are unnecessary talking, sleeping, tardiness, leaving class while instructor is lecturing, sharpening pencils during the lecture, etc.
* No Food Allowed In Classroom.
* Chronic tardiness and discourteous behavior will not be tolerated and is cause for a student's dismissal from class for the remainder of the semester.

**UTRGV Policy Statements**

UTRGV requires all electronic communication between the University and students be conducted through the official University supplied systems UTRGV-Mail. Please use your UTRGV-Mail account for all correspondence with me.

**Calculators, Cell Phones, and Other Electronic Equipment**

Calculators will be permitted for use on quizzes and exams. Electronic equipment such as cell phones, pocket organizers, tablet or laptop computers, or electronic writing pads or pen-input devices will not be permitted during quizzes and exams. Please make sure that cell phones are turned off and stored way during class.

**MANDATORY COURSE EVALUATION PERIOD:**

Students are required to complete an ONLINE evaluation of this course, accessed through your UTRGV account ([*https://my.utrgv.edu/home*](https://my.utrgv.edu/home)); you will be contacted through email with further instructions. Students who complete their evaluations will have priority access to their grades. Online evaluations will be available: Apr 12 – May 3 for full spring semester courses

**ATTENDANCE:** Students are expected to attend all scheduled classes and may be dropped from the course for excessive absences. UTRGV’s attendance policy excuses students from attending class if they are participating in officially sponsored university activities, such as athletics; for observance of religious holy days; or for military service. Students should contact the instructor in advance of the excused absence and arrange to make up missed work or examinations.

**STUDENTS WITH DISABILITIES:**

If you have a documented disability (physical, psychological, learning, or other disability which affects your academic performance) and would like to receive academic accommodations, please inform your instructor and contact Student Accessibility Services to schedule an appointment to initiate services. It is recommended that you schedule an appointment with Student Accessibility Services before classes start. However, accommodations can be provided at any time. **Brownsville Campus**: Student Accessibility Services is located in Cortez Hall Room 129 and can be contacted by phone at (956) 882-7374 (Voice) or via email at ability@utrgv.edu. **Edinburg Campus:** Student Accessibility Services is located in 108 University Center and can be contacted by phone at (956) 665-7005 (Voice), (956) 665-3840 (Fax), or via email at ability@utrgv.edu.

**SCHOLASTIC INTEGRITY:**

As members of a community dedicated to Honesty, Integrity and Respect, students are reminded that those who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and expulsion from the University. Scholastic dishonesty includes but is not limited to: cheating, plagiarism, and collusion; submission for credit of any work or materials that are attributable in whole or in part to another person; taking an examination for another person; any act designed to give unfair advantage to a student; or the attempt to commit such acts. Since scholastic dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced (Board of Regents Rules and Regulations and UTRGV Academic Integrity Guidelines). All scholastic dishonesty incidents will be reported to the Dean of Students.

**SEXUAL HARASSMENT, DISCRIMINATION, and VIOLENCE:**

In accordance with UT System regulations, your instructor is a “responsible employee” for reporting purposes under Title IX regulations and so must report any instance, occurring during a student’s time in college, of sexual assault, stalking, dating violence, domestic violence, or sexual harassment about which she/he becomes aware during this course through writing, discussion, or personal disclosure. More information can be found at [www.utrgv.edu/equity](http://www.utrgv.edu/equity), including confidential resources available on campus. The faculty and staff of UTRGV actively strive to provide a learning, working, and living environment that promotes personal integrity, civility, and mutual respect in an environment free from sexual misconduct and discrimination.

**COURSE DROPS:** According to UTRGV policy, students may drop any class without penalty earning a grade of DR until the official drop date. Following that date, students must be assigned a letter grade and can no longer drop the class. Students considering dropping the class should be aware of the “3-peat rule” and the “6-drop” rule so they can recognize how dropped classes may affect their academic success. The 6-drop rule refers to Texas law that dictates that undergraduate students may not drop more than six courses during their undergraduate career. Courses dropped at other Texas public higher education institutions will count toward the six-course drop limit. The 3-peat rule refers to additional fees charged to students who take the same class for the third time.

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| **Fall 2018 Term (August 27 – December 13)** |
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| Aug. 22 (Wed.) | Payment DueLast day to join a waitlist |
| Aug. 24 (Fri.) | Last day to withdraw (drop all classes) and receive a 100% refund |
| Aug. 27 (Mon.) | Fall classes begin |
| Aug. 30 (Thurs.) | Last day to add or register for Fall classes |
| Aug. 31 (Fri.) | Last day to withdraw (drop all classes) and receive an 80% refund |
| Sept. 3 (Mon.) | Labor Day Holiday. No classes. |
| Sept. 10 (Mon.) | Last day to withdraw (drop all classes) and receive a 70% refund |
| Sept. 12 (Wed.) | Census Day (*last day to drop without it appearing on the transcript*) |
| Sept. 17 (Mon.) | Last day to withdraw (drop all classes) and receive a 50% refund |
| Sept. 24 (Mon.) | Last day to withdraw (drop all classes) and receive a 25% refund |
| Nov. 14 (Wed.) | Last day to drop *(DR grade)* a class or withdraw *(grade of W)* |
| Nov. 22 – Nov. 24 (Thurs. – Sat.) | Thanksgiving Holiday. No classes |
| Dec. 6 (Thurs.) | Study Day. No classes. |
| Dec. 7 – Dec. 13 (Fri. – Thurs.) | Final Exams |
| Dec. 13 (Thurs.) | Fall classes end; Official last day of the term |
| Dec. 14 – Dec. 15 (Fri. – Sat.) | Commencement Exercises |
| Dec. 17 (Mon.) | Grades Due at 3 p.m. |

# Math 3350 Homework Assignments

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| Chapter | Section | Pages | Problems |
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