MAT 300 - Introduction to Mathematical Structures

Any in-class announcement, verbal or written, is considered official addendum to this syllabus.

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<thead>
<tr>
<th>Instructor: Dr. R. Boerner</th>
<th>Office: ECA 205</th>
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<tbody>
<tr>
<td>E-Mail: <a href="mailto:rboerner@asu.edu">rboerner@asu.edu</a></td>
<td>Office Hours: Monday 2:20 to 2:50 or by appointment, subject to availability.</td>
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Please put „MAT 300“ into the subject line when you email me.

Course Description: Logic and set theory, induction, functions, order and equivalence relations, cardinality. Emphasizes writing proofs and critical reasoning.

The single most important learning goal in the class is the ability to write proofs.

Textbook: How to Prove It; A Structured Approach by Daniel Velleman (Cambridge) 2nd. Ed

Grading: The grade will be computed from the Final Exam (25%), 3 Midterm Tests (20% each), Quizzes (5%), Written Homework (5%) and Webwork (5%).

Grading Scale:

A-, A, A+: 90-92.9, 93-96.9, 97-100% ; B-, B, B+: 80-82.9, 83-86.9, 87-89.9% ;
C, C+: 70-75.9, 76-79.9%; D 60%–69.9%; E: 59.9% or less.

Please take these cutoffs literally. A- from 90 to 92.9 means that a 92.9 is an A-. Please do not attempt to negotiate the cutoffs. They had to be set somewhere, and this is how they are set.

Quizzes: Quizzes may be either announced or unannounced, and are given at the discretion of the instructor. Quizzes frequently reflect material that has recently been discussed in class. No make up quizzes will be given.

Homework: Written Homework will be collected electronically through Canvas. You will have to type your solutions (using proper mathematical typesetting) and upload them in pdf format.

Homework is a very important part of your learning. You cannot expect to solve all assigned problems easily. Some problem will require more time and effort. Even if you are unable to solve the entire problem, any time spent on trying is not wasted. I recommend that you form study groups to work together on the problems to come up with ideas but everyone has to write his or her homework individually. You need to explain everything on your homework solutions for full credit.

Webwork: online homework that is assigned in addition to written homework. Go to http://webwork.asu.edu (Links to an external site.) and click on MAT 300 Boerner.

Exams: Two midterm exams will be given during the session. The best possible preparation for the exams is regular attendance and completion of assigned homework and written work. The exams will be given in class on the dates indicated on the exam schedule. Make up exams are at the discretion of
the instructor and only in the case of verified medical or other emergency. The instructor must be notified by email before the exam is given.

**Success Habits** You must study the corresponding sections in the textbook in addition to attending lectures. Students are responsible for assigned material whether or not it is covered in class. Students are responsible for material covered in class whether or not it is in the text. **Working regularly** on assigned problems and **attending class** are essential to survive.

Ideally, you read study each section in the textbook before the material is covered in class. “Math is best learned by knowing it already.”

**Cellphone Policies:** Students are asked to turn off electronic devices such as cell phones and laptops, and put them away during class. Please do not just put them into standby, but power them down.

Any student who accesses a phone or any internet-capable device during an exam for any reason receives a score of zero on the exam. All such devices must be turned off and put away and made inaccessible during the exam.

**Tutoring** can be found in the Math Community Center WXLR 303.

**Academic Dishonesty**
Academic honesty is expected of all students in all examinations, papers, laboratory work, academic transactions and records. The possible sanctions include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of E), course failure due to academic dishonesty (indicated on the transcript as a grade of XE), loss of registration privileges, disqualification and dismissal. For more information, see http://provost.asu.edu/academicintegrity.

**Final Exam:** The final exam is **comprehensive** and will be administered on Friday, May 3, 2019, 2:30 - 4:20 PM. (The location is most likely the regular classroom, but this may not be confirmed until April.)

The final exam schedule will be strictly followed. Except to resolve those situations described below, no changes may be made in this schedule without prior approval of the Dean of the college in which the course is offered. Under this schedule, if a conflict occurs, or a student has more than three exams on one day, the instructors may be consulted about an individual schedule adjustment. If necessary, the matter may be pursed further with the appropriate dean(s). This procedure applies to conflicts among any combination of Downtown Phoenix campus, Tempe campus, Polytechnic campus, West campus, and/or off campus class.

Make-up exams will **NOT** be given for reasons of a non-refundable airline tickets, vacation plans, work schedules, weddings, family reunions, and other such activities. Students should consult the final exam schedule before making end-of-semester travel plans.

**Important dates:**
- Spring Break: March 3-10, 2019
- Course Withdrawal Deadline: March 31st 2019.

**Sections covered:**
- 1.1-1.5, 2.1-2.3, 3.1-3.6, 6.1, 4.1-4.4, 4.6, 5.1-5.3, 7.1-7.2
Tentative Schedule:

<table>
<thead>
<tr>
<th>Week</th>
<th>Section and Topic Covered</th>
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<tr>
<td>1 1/7, 1/9</td>
<td>1.1, 1.2 Logical Connectives, Truth Tables</td>
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<tr>
<td></td>
<td>1.3, 1.4 Variables and Sets, Operations on Sets</td>
</tr>
<tr>
<td>2 1/14, 1/16</td>
<td>1.5 The Conditional and Biconditional</td>
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<tr>
<td></td>
<td>2.1 Quantifiers</td>
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<td>3 1/23 (1/21 is a school holiday)</td>
<td>2.2 Equivalences involving Quantifiers,</td>
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<tr>
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<td>2.3 More Operations on Sets</td>
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<tr>
<td>4 1/28, 1/30</td>
<td>3.1 Proof Strategies</td>
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<tr>
<td></td>
<td>3.2 Proofs Involving Negations and Conditionals</td>
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<tr>
<td>5 2/4, 2/6</td>
<td><strong>Exam 1</strong></td>
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<tr>
<td></td>
<td>3.3 Proofs Involving Quantifiers</td>
</tr>
<tr>
<td>6 2/11, 2/13</td>
<td>3.4 Proofs Involving Conjunctions and Biconditional</td>
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<tr>
<td></td>
<td>3.5 Proofs Involving Disjunctions</td>
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<tr>
<td>7 2/18, 2/20</td>
<td>3.6 Existence and Uniqueness Proofs</td>
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<tr>
<td></td>
<td>6.1 Proof by Mathematical Induction</td>
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<td>8 2/25, 2/27</td>
<td>4.1 Ordered Pairs and Cartesian Products</td>
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<td></td>
<td>4.2 Relations</td>
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<td>Spring Break March 3-10</td>
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<tr>
<td>9 3/11, 3/13</td>
<td>4.3 More about Relations</td>
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<tr>
<td></td>
<td>4.4 Ordering Relations</td>
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<tr>
<td>10 3/18, 3/20</td>
<td><strong>Exam 2</strong></td>
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<tr>
<td></td>
<td>4.6 Equivalence Relations</td>
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<tr>
<td>11 3/25, 3/27</td>
<td>5.1 Functions</td>
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<td>5.2 One-to-one and Onto Functions</td>
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<td>12 4/1, 4/3</td>
<td>5.3 Inverses of Functions</td>
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<td>7.1 Equinumerous Sets</td>
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<tr>
<td>13 4/8, 4/10</td>
<td>7.2 Countable and Uncountable Sets</td>
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<td>14 4/15, 4/17</td>
<td><strong>Exam 3</strong></td>
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<tr>
<td>15 4/22, 4/24</td>
<td>Review for Final Exam</td>
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**EXAM SCHEDULE**

| EXAM 1 | February 4th in class |
| EXAM 2 | March 18th in class   |
| EXAM 3 | April 15th in class   |
| FINAL EXAM | Friday, May 3, 2019, 2:30 - 4:20 PM |

**Studying for the class:**

While diligent and timely completion of the homework assignments is necessary to pass the class, it is not sufficient to gain conceptual understanding.

To master the concepts, you must review and study your notes and the textbook thoroughly with the goal of understanding the connections between the concepts. If you could explain it to someone else clearly, then you are "getting it".
Create your own lists (or perhaps 3x5 cards) of definitions, procedures and theorems and commit them to memory like you would do with vocabulary in any language. Writing helps to build active knowledge.

It is imperative for success in the class that you commit to memory the exact definitions of concepts. Not knowing the exact definitions is like trying to master a language without knowing the vocabulary. Not knowing exactly what the terms mean guarantees failure in the class.

You must learn and study continuously throughout the duration of the class. Relying on “just in time cramming for homework and exams is an ineffective study technique.

Do not abuse help. Math learning happens when you struggle with a problem. If you ask for help at the slightest sign of difficulty and are presented with the solution, you learn very little.

It is important that you realize early on how fundamentally different written homework in a near-graduate level class like this one is from homework in 100-200 level mathematics classes.

Homework assignments in lower level math classes are usually of a routine nature, and require nothing more than plugging numbers into a formula, or following a procedure learned in class. Students expect the solution method to be immediately apparent, and if no such method occurs to them within minutes, they ask for help from a tutor or teacher. Problems that challenge them to think are dismissed as “trick questions assigned by an unreasonable teacher.

It is precisely those types of problems that stimulate and expand your understanding and eventually lead you to true mastery of mathematics. That’s why virtually all homework questions in graduate math classes – and some homework problems you will work in this course – are challenging. You’re not supposed to figure them out in 5 minutes. A single challenging homework problem could very well require an entire Saturday afternoon until that magical Eureka moment happens and the pieces of the puzzle come together.

“It’s not that I’m so smart, it’s just that I stay with problems longer. -- Einstein

You are welcome to come to office hours to ask for hints on the homework or to ask questions about the class material, but I will not do your homework for you. Office hours are not a personal tutoring service.

**Written Homework Problems Assigned:**

1.2: 1, 2, 9, 15, 17
1.3: 4, 8(b,c)
1.4: 4, 5, 9, 13
1.5: 3, 5, 10
2.1: 3(b,c,d), 5, 7, 8, 9
2.2: 1(b,c,d), 2(c,d), 3, 5, 9, 12(a,b,c,d)
2.3: 6, 10, 11, 12(a,c)
3.1: 1, 3, 5, 6, 7, 8, 9, 10, 11, 12
3.2: 3, 4, 7, 9, 11, 12
3.3: 2, 3, 6, 7, 18, 19
3.4: 2, 3, 4, 5, 8, 9, 10, 11, 25, 26
3.5: 1, 2, 4, 6, 8, 9, 10, 13, 14
3.6: 1, 2, 3
6.1: 1, 2, 3, 4, 5, 7, 10, 12, 14, 16
4.1: 5, 7, 8, 9
4.2: 1(b), 2(b), 4, 9
4.3: 11, 12, 13, 14
4.4: 1(b,c), 4, 5, 13, 17
4.6: 4, 9, 10, 12, 13
5.1: 1(a,b), 2(a), 6, 8, 9(a)
5.2: 5, 6, 8, 9, 11, 17
5.3: 3, 4, 5, 6, 11
6.4: 5, 6(a,b)
7.1: 1, 3, 7, 11
7.2: 1, 3

Proof is required on all homework assignments including the ones that do not explicitly ask for proof. Logical correctness is of paramount importance. For full credit, your homework must show all arguments leading to the desired statement in a clear sequence. You may assume common algebraic facts and theorems previously proved in class, in sections of the textbook that correspond to material covered in class or on the homework as given, but you must quote them when you use them (“by theorem 1.1 on page 2, we know that.. or “by homework problem 3 on page 4, it follows..”). You may not assume theorems that have yet to be covered. You may not cite a theorem as proof of that theorem.

Grading the written homework is the job of a graduate TA. Only a subset of assigned homework problems will be graded.

Honors Enrichment Contracts Policy: To quote the Honors College, “The primary purpose of the Honors Enrichment Contract is to give students and faculty the opportunity to interact about challenging academic issues.

An Honors contract requires at least 8 hours of in-person meetings between the student and faculty. It represents a significant commitment on both sides. To ensure a reasonable chance of success of honors contracts, I will only consider honors contract proposals from students who have received a grade of at least 90% on their first exam.

Students with Disabilities
Disability Accommodations: Qualified students with disabilities who will require disability accommodations in this class are encouraged to make their requests to me at the beginning of the semester either during office hours or by appointment. Note: Prior to receiving disability accommodations, verification of eligibility from the Disability Resource Center (DRC) is required. Disability information is confidential.

Establishing Eligibility for Disability Accommodations
Students who feel they will need disability accommodations in this class but have not registered with the Disability Resource Center (DRC) should contact DRC immediately. Their office is located on the first floor of the Matthews Center Building. DRC staff can also be reached at: 480-965-1234 (V), 480-965-9000 (TTY). For additional information, visit: www.asu.edu/studentaffairs/ed/drc. Their hours are 8:00 AM to 5:00 PM, Monday through Friday.
Policy on Threatening Behavior
All incidents and allegations of violent or threatening conduct by an ASU student (whether on-or off campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students. If either office determines that the behavior poses or has posed a serious threat to personal safety or to the welfare of the campus, the student will not be permitted to return to campus or reside in any ASU residence hall until an appropriate threat assessment has been completed and, if necessary, conditions for return are imposed. ASU PD, the Office of the Dean of Students, and other appropriate offices will coordinate the assessment in light of the relevant circumstances.

Classroom behavior: Make sure you arrive on time for class. Excessive tardiness will be subject to sanctions. Under no circumstances should you allow your cell phone to ring during class. Any disruptive behavior, which includes ringing cell phones, listening to your mp3/iPod player, text messaging, constant talking, eating food, reading a newspaper will not be tolerated. The use of laptops (unless for lecture note taking), cell phones, music players, etc. are strictly prohibited during class. Students are requested to turn all electronic devices off while in class, i.e. power them down (not just put them into stand-by). Students who wish to use an electronic device for note taking should talk to the instructor in person first.

Students who engage in disruptive classroom behavior may be subject to various sanctions. The procedures for initiating a disruptive behavior withdrawal can be found at https://clas.asu.edu/resources/disruptive-behavior.

Absences related to religious observances/practices: If you will be absent from class due to a religious observance or practice, it is your responsibility to inform the instructor during the first week of class. Your instructor will work with you on alternative and reasonable arrangements for any time missed.

Absences related to university sanctioned events and activities: If you will be absent from class due to participation in a university sanctioned event/activity, it is your responsibility to inform the instructor during the first week of class. Your instructor will work with you on alternative and reasonable arrangements for any time missed.

Title IX policy:
Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs

As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling (Links to an external site.)Links to an external site, is available if you wish discuss any concerns confidentially and privately.
Preferred Names and Pronouns policy:
The School of Mathematical and Statistical Sciences encourages faculty to address and refer to students by their preferred name and gender pronoun. If your preferred name is different than what appears on the class roster, or you would like to be addressed using a specific pronoun, please let your instructor know.

Fragrances: Fragrance sensitivity is an emerging public health crisis. The instructor requests and encourages students to abstain from wearing perfumes, colognes and clothes with laundry or dryer sheet fragrances to class. Please read the presentation Fragrances in the College Classroom (Links to an external site.)Links to an external site. for a full explanation of this request.