INSTRUCTOR:  Frank T. Shirley, PhD, MM

Office: PMA 13.164

Office Hours:  T, TH: 3:45-5:30 PM

and by appointment

**e-mail:  shirley@math.utexas.edu**

When sending email, "**M 325K**" must be included in the subject line.

TEXTBOOK: *Discrete Mathematics*, *Brief Edition*, by Susanna Epp.  ( **NOT THE 4th Edition!** )

Each student automatically has access to a digital eBook through the Longhorn Textbook Access Program

(LTA) and will be charged a nominal fee unless he/she opts out of the LTA before the 12th class day.

**Course Description:** A main goal of this course is to understand and to create mathematical proofs.  Students are expected to become familiar with the language and techniques of proofs and should develop the ability to read proofs, to understand proofs, and to create proofs on their own.  Topics include the fundamentals of logic, set theory, basic properties of the integers and elementary number theory, methods of proof, mathematical induction, functions, and relations.

**Required materials:**  (1) A computer with a functioning camera and microphone

(2) A smart phone or access to a scanner device or to a printer with a scanning function.

**Course pre-requisites:**  Mathematics 408D, 408L, or 408S with a grade of at least C-.

**Grades:**

There will be 3 mid-semester exams and a final exam.  The first mid-semester exam is worth 18% and the other two mid-semester exams are each worth 20% in the final average. Homework will be assigned regularly, and the final homework average is worth 12% in the final average. Quizzes will be given and the final quiz average is worth 6% of the final average. The Final Exam is worth 24% in the final average.  **If your Final Exam grade is greater than your lowest mid-semester test grade, then your lowest mid-semester test grade will be replaced by the average of your Final Exam grade and your lowest mid-semester test grade**.

The FORMULA for calculating the FINAL AVERAGE:

FINAL AVERAGE  =  0.12∗(HW AVG)  +  0.18∗(TEST 1)  +  0.20∗(TEST 2)

+  0.20∗(TEST 3)  +  0.06∗(QUIZ AVG)  +  0.24∗(FINAL EXAM)

Letter Grades are awarded according to the FINAL AVERAGE  as follows:

92 - 100 : A ;  90 - 92 : A− ;  88 - 90 : B+ ; 82 - 88: B ;  80 - 82 : B− ;  etc,

The **FINAL EXAM** for this class will be given on **Friday, May 3,  10:30 AM  –  12:30 PM**

   The mid-semester exams are TENTATIVELY scheduled to be given as follows:

      Test 1:  Thursday, February 15
      Test 2:  Thursday, March 21
      Test 3:  Thursday, April 11

All handouts will be posted for download and most (but not all) of them will be handed out in class.
**READING THE HANDOUTS IS VERY IMPORTANT !**

**Attendance:** Attendance at the Tuesday and Thursday lectures required. Each student is allowed four (4) unexcused absences without penalty, and every unexcused absence after the first four results in the final semester average being reduced by 1/2 point.  Absences can be excused only for illness and for a religious holiday.  For an absence due to illness to be excused, the student must be examined by a health professional who provides the student with a receipt or a report.

**Homework:**  Homework will be assigned frequently, collected at the beginning of class, and graded.

   Your homework average is 12%  of the final average.  When turning in homework papers, **the papers must be stapled together**, and the solutions to the problems must be presented in the order in which the problems are assigned.

   Students will write their homework solutions on their own paper and document them as follows:
   Fold the papers along the vertical center-line and print on the top:

Your Name
HW # xx
M325K
SHIRLEY

   **When sending an email message to Dr. Shirley,  "M 325K" must be included in the Subject line.**

**Quizzes:** Quizzes will be given frequently, and they are of two types.   Mini-Lecture Video quizzes and pop-quizzes given during the lectures. The final Quiz Average is the average of the grades of all the quizzes of both types.  **The four lowest grades on the in-class pop quizzes will be dropped** when calculating your Quiz Average.  Make-up quizzes will not be given.

**Tests:**
   **If a student misses an exam due to illness**, the student needs to inform Dr. Shirley by email of the illness on the day of the exam. Furthermore, the student should go to a health professional for an examination, and, with a record of the visit, the student may take a make-up exam.
**If a student will miss an exam for the observance of a religious holiday**, the student must notify Dr. Shirley one week before the exam to schedule a make-up exam.

**Calculator Policy:** During exams, you are **not allowed to use graphing calculators** nor calculators which can store text of any kind in memory.  **You may only use a basic scientific calculator.**

## OTHER IMPORTANT INFORMATION

### Last Day to Drop:
*The main drop deadline is Tuesday, March 26.*
This is the last day an undergraduate student may, with the dean's approval, withdraw from the University or drop a class except for urgent and substantiated, nonacademic reasons.  It is the last day an undergraduate student may change registration in a class to or from the pass/fail basis.

### Academic Accommodations for Students with Disabilities:
Any student with a documented disability (physical or cognitive) who requires academic accommodations should contact the Division of Diversity and Community Engagement (DDCE), Disability and Access (D&A) at the address: http://www.utexas.edu/ugs/slc,  or phone: 512-471-6259 (voice) or 512-471-4641 (TTY for users who are deaf or hard of hearing) or by fax  at 512-475-7730  as soon as possible to request an official letter outlining authorized accommodations.

### Resources for Counseling and Mental Health:
Counseling and Mental Health Center
Student Services Bldg (SSB), 5th Floor
Hours: M--F 8am--5pm

512 471 3515 (appointments)
512 471 CALL (crisis line)

### Class Recordings:

Class recordings are reserved only for students in this class for educational purposes and are protected under FERPA. The recordings should not be shared outside the class in any form. Violation of this restriction by a student could lead to Student Misconduct proceedings.

### Sharing of Course Materials is Prohibited:

No materials used in this class, including, but not limited to, lecture hand-outs, videos, assessments (quizzes, exams, papers, projects, homework assignments), in-class materials, review sheets, and additional problem sets, may be shared online or with anyone outside of the class unless you have my explicit, written permission. Unauthorized sharing of materials promotes cheating. It is a violation of the University's Student Honor Code and an act of academic dishonesty. I am well aware of the sites used for sharing materials, and any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in sanctions, including failure in the course.

### Academic Integrity Policy:

Students who violate University rules on academic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on academic dishonesty will be strictly enforced. For further information, please visit the Student Conduct and Academic Integrity website at http://deanofstudents.utexas.edu/conduct (Links to an external site)

**Tentative Course Schedule:**

    The following list shows the topics to be discussed in the lectures.  This list represents the initial plans of these topics.  During the course of the semester, these plans may change and the topics are only tentatively scheduled.  If there is going to be any significant change in the schedule, these changes will be announced in class and in Canvas in advance.

| Class Day | To be Discussed |
|---|---|
| T, Jan 16 | "Adequately Defined Variables and Inadequately Defined Variables" and the "(mod n) Congruence" Relationship that two Integers might have. |
| TH, Jan 18 | Sec 2.1: Logic,  Statements, Statement Forms, Truth Tables, Negations, Equivalent Statements, De Morgan's Laws.   Also, Sec 2.2, the Conditional (If-Then) Statement |
| T, Jan 23 | Sec 2. 2: Conditional Statements related to the Original Conditional, Other Equivalent Wordings.  Also, the "(mod n) Congruence Theorem." |
| TH, Jan 25 | Sec 2.3: Valid and Invalid Arguments, Argument Forms, Fallacy Forms Sec 3.1: Predicate Calculus; Quantifiers; Universal Statements; Existential Statements. |
| T, Jan 30 | Sec 3.2:  Negations of quantified statements; Other wordings of conditional statements. and Sec 3.3:  Using multiple quantifiers in a statement, and Arguments with Universally Quantified Statements. |
| TH, Feb 1 | Sec 4.1: Deductions, and Section 4.2: Writing Proofs, Using the "In the Book" Definitions and the "Ground Rules" of Proof Writing, and the Direct Proof Method for proving Universal Statements. |
| T, Feb 6 | Sec 4.3: Number Theory: Divisibility, the Quotient-Remainder (Q-R) Theorem and "the (K Div n)" and "the (K Mod n)"  Functions. |
| TH, Feb 8 | Proving Theorems about the (K Mod n) Function, The Unique (Prime) Factorization Theorem,  Theorems (NIB) #1,2,3 |
| T, Feb 13 | Sec  4.4: Writing proofs using Division-into-Cases; The Parity Corollary, and Sec 4.5: Proof-by-Contradiction ; Sec 4.6:  Proof that $\sqrt{2}$  is an irrational number |
| TH, Feb 15 | Test 1 |
| T, Feb 20 | Sec 4.5: Proof-by-Contraposition; Sec 5.1 and Sec 5.2: An introduction to Mathematical Induction. |
| TH, Feb 22 | Sec 5.3: More on Mathematical Induction, and Sec 5.4: Strong Mathematical Induction (SMI) |
| T, Feb 27 | Sec 5.4: More on Strong Mathematical Induction, and Sec 5.4: Strong Mathematical Induction (SMI) |
| TH, Feb 29 | Sec 6.1 and Sec 1.2:  An Introduction to Set Theory and Set Operations. "Guidelines for Writing Elemental Proofs" in Set Theory; |

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| Class Day | To be Discussed |
|---|---|

T, Mar 5      Sec 6.2: Writing Elemental Proofs in Set Theory, proofs of Subset Relationships,
         Proving that a particular set is the Empty Set using Proof-by-Contradiction,
         :        The Power Set

TH, Mar 7      More on Writing Elemental Proofs in Set Theory,
         Sec 6.3: Algebraic Proofs in Set Theory using Standard Set Identities;
         Also, proving that a Conjectured Identity is False.

Mon, Mar 11, to Sat, Mar 16:    Spring Break

T, Mar 19      Sec 8.1: Introduction to Relations and Inverse Relations.
         Sec 8.2: Properties that a relation may or may not have:
         the Identity Property, the Symmetric Property, and the Transitive Property.

TH, Mar 21      Test 2

T, Mar 26      Sec 8.3: Equivalence Relations and their Equivalence Classes,
         Elemental Proofs of General Theorems on Equivalence Relations.

TH, Mar 28      The "Congruence (mod 3)" Equivalence Relation on $\mathbf{Z}$.
         Sec 8,4 from Epp's 4th Edition (4E): Modular Arithmetic.

T, Apr 2      Sec 8,4 4E): More on Modular Arithmetic: Finding the "Least Residue (mod n) of the integer K,
         the Euclidean Algorithm for finding the Greatest Common Divisor, gcd(a,b), of a and b,
         Writing the gcd( m , n ) as a linear combination of m and n.  Relatively prime integers.

TH, Apr 4      Sec 8.4 (4E): Modular (mod n) Inverses, and
         Solving simple congruences with modular inverses;
         The RSA Cryptography for Computer Encryption.

T, Apr 9      More on RSA Cryptography.
         Sec 7.1: Functions, Sec 7.2: One-to-One Functions and Onto Functions.

TH, Apr 11      Test 3

T, Apr 16      Proving that a function is not an onto function.
         Sec 7.3: The composition of two or more functions.
         Equality of functions; The Inverse Function $\mathbf{f^{-1}}$.

TH, Apr 18      Sec 7.4: Cardinality of Sets: Countable Sets

T, Apr 23      More on Cardinality of Sets: Uncountable Sets

TH, Apr 25      Last Class Day: The Continuum Hypothesis

GOOD LUCK AND HAVE A GREAT SEMESTER!