Syllabus for Math 245, *Introduction to Proof via Discrete Math*, Spring 2020

Instructor: Dr. Elizabeth A. Arnold
e-mail: arnoldea@jmu.edu
Phone: 568-6532
URL: *educ.jmu.edu/~arnoldea*
Office: Roop 111
Office Hours: MW 12:15pm-1:30pm, F 9:00-10:00am and by appointment.

COURSE GOALS: Math 245 is a "bridge course" designed to be a transition for math majors and minors from the computational courses like calculus, to the proof based courses such as number theory and analysis. In this course we will study logic, sets and relations, proof techniques, and discrete math. It is hoped that by the end of the course, you will read, write and think mathematics like a mathematician. Specific topics include mathematical induction, combinatorics, cardinality and Pascal's triangle.

REQUIRED TEXT: *Doing Mathematics*, Stephen Galovich

SUPPLEMENTAL TEXTS:

LaTeX: A Document Preparation System, Leslie Lamport
Mathematics: A Discrete Introduction, E. Scheinerman
How to Prove It: A Structured Approach, D. Velleman
A Transition to Advanced Mathematics, Smith, Eggen and St. Andre
A Discrete Transition to Advanced Mathematics, Richmond and Richmond
Foundations of Higher Mathematics, Fletcher and Patty

Note: These books are for reference only. You do not need to purchase any of them.

GRADING: The grading will be assigned the following scale:
A: 90-100%, B: 80-89% , C: 70-79%, D 60-69%, F: Below 60%
There will be no curves and no extra credit. I will assign +/- on an individual basis. Points are assigned as follows:
Quizzes (10) - 100 points, Midterm exams (2) - 100 points each, Homework - approximately 80 points, Final exam - 150 points

QUIZZES: There will be a 10 point quiz each Friday. This quiz will cover material through the previous class. Quiz questions will consist mainly of definitions, theorems, short answers, and short proofs. The 10 best quiz scores will be kept, and the rest will be dropped. There will be no make up quizzes given. The quizzes are a good way for you to gauge your understanding of the current material and to keep up with the homework.

LaTeX: As part of our objective to "write" mathematics (as well as to learn it and to speak it) we will learn to use the mathematical typsetting program LaTeX. LaTeXis the standard typesetting tool of mathematicians all over the world. Whether you will be teaching, working in business or in academia, LaTeXwill be useful for preparing mathematical documents. See canvas or my website for information on installing and running LaTeX.

HOMEWORK: Homework will be assigned after each section. We will discuss the homework, but most of it will not be collected. About once a week or so I will assign problems to be typed in LaTeXand handed in for grading. Late assignments will not be accepted.

MIDTERMS and FINAL: There will be two midterms during the semester worth 100 points each and a final exam worth 150 points. The questions on the exams will be similar to homework questions and will contain proofs. If you cannot make it to a scheduled exam, you MUST contact me BEFORE the exam if at all possible, or if an emergency, WITHIN 24 HOURS after the exam if you need to schedule a make up exam. Make up exams will only be given for extreme excuses.
Dates for exams (subject to change): Midterm I - Monday February 17, Midterm II - Monday April 13, **Final Exam** - Wednesday May 6, Section 001 8:00-10:00am, Section 002 10:30am-12:30pm

CLASS STRUCTURE: Each Friday there will be a quiz during class which will cover material since the last quiz or exam. Homework problems will be discussed at the beginning of class as time allows. The rest of the class will be lecture.

ADDITIONAL HELP: You are encouraged to work together in this class and form study groups. But any work you turn in must be your own. TALK about mathematics with each other. WRITE down your thoughts and ideas. SHARE these ideas with your group and with the class. Before each class you should read the section that is to be covered. Write down any definitions, theorems and boilerplates from class on index cards. Use these cards to study for the quizzes and exams. You should know the definitions for quizzes and exams. You do not have to know the definition word for word from the text or the notes, but it should be correct and complete. You are welcome to e-mail homework questions to me, but if you are referring to a homework problem, please include the entire question, because I may not have access to a book when I answer your e-mail.

HONOR CODE: You are to abide by the JMU honor code at all times. Ignorance of the law is no excuse. Cheating will not be tolerated and will be prosecuted to the fullest extent. Please familiarize yourself with the honor code here: `http://www.jmu.edu/honor/code.shtml`. When turning in homework or group work, you may work together and discuss the problems, but you must write up the homework to turn in **by yourself**. Every answer requires an explanation, and no two student's explanations will be exactly the same. Copying someone else's homework or copying something from the internet - even if you change a few words or symbols - without citation is a violation of the Honor Code. Do not share your LaTeXcode with anyone. You are welcome to look at each other's code, but do not share files, and do not copy code from someone else word for word.

FIRST WEEK ATTENDANCE POLICY: At the instructor's discretion, any student registered for a class in the Department of Mathematics and Statistics who does not attend at least one of the first two scheduled meetings of the class MAY be administratively dropped from the class. Students will be notified by e-mail if they will be dropped. Students who fail to attend should not assume they will be administratively dropped by their instructor; it is the students responsibility to drop the course on their own or they will receive a grade at the end of the semester. All students are responsible for verifying the accuracy of their schedules and changes made in their schedules.

LEARNING: Your goal in this class is to learn proofs and discrete math. My role is to facilitate that learning. You will get out of this class what you put in to it. There are no shortcuts. You MUST do the homework. You MUST study for the quizzes each week. You MUST get help as soon as you do not understand a concept so that you can LEARN it and move on to the next one. Learning is not easy. It takes effort and persistence. It is a struggle. Do not see your mistakes as failures, but rather as learning opportunities! It is the struggle that leads to learning. Embrace the challenge.

Math 245 Spring 2020 VERY tentative outline

Week 1 **January 13-17** Class overview, introduction to LaTeX, Section 2.1 Truth Tables

Week 2 **January 20-24** No class Monday, MLK Day. Section 2.2 Sets, Section 2.3 Quantifiers,

Week 3 **January 27-31** 3.1 Direct Proof

Week 4 **February 3-7** Section 3.2 Indirect Proof, Section 3.3 Induction

Week 5 **February 11-14** 3.4 Case Analysis, Review

Week 6 **February 17-21 Monday Midterm I, Ch 2, 3**, Section 4.1 Set Operations

Week 7 **February 24-28** Section 4.2 Relations,

Week 8 **March 2 - March 6** Section 4.3 Functions

March 9-15 Spring Break

Week 9 **March 16-20** 4.4 Equivalence Relations

Week 10 **March 23-March 27** Section 5.1 Equinumerous Sets, Section 5.2 Finite Sets

Week 11 **March 30-April 3** 5.3 Denumerable Sets

Week 12 **April 6-10** Section 5.4 Uncountable Sets, Catch up, Review,

Week 13 **April 13-17 Monday Midterm II Ch. 4, 5**, Section 6.1 Combinatorics, 6.2 Permutations and Combinations

Week 14 **April 20-24** Section 6.3 Binomial Theorem, 4.5 Natural/Rational Numbers

Week 15 **April 27** Sections 4.6 Real/Complex Numbers
Wednesday April 29 Review **Last Day of Class**

Week 16 **Wednesday May 6 Final Exam** Section 001 8:00am-10:00am, Section 002 10:30am-12:30pm

Math 245 Spring 2020 Homework Problems

- Section 2.1 Truth Tables: 1, 2, 3, 4, 6, 8, 10, 12, 15, 16, 18
- Section 2.2 Sets: 3, 4, 5, 8, 9, 10, 12, 19
- Section 2.3 Quantifiers: 1-27
- Section 3.1 Direct Proof: 1, 2, 3, 4, 6-14, 18, 19
- Section 3.2 Indirect Proof: 1-5, 7-11, 13
- Section 3.3 Induction: 1-4, 7, 9, 11, 13, 18, 20, 21, 24, 25
- Section 3.4 Case Analysis: 1, 3, 4, 6, 9, 10
- Section 4.1 Set Operations: 1-10, 15, 21, 22
- Section 4.2 Relations: 2, 4, 6, 7, 10, 12, 14, 15, 16, 18, 27
- Section 4.3 Functions: 1-3, 14-17, 20, 23, 24, 31
- Section 4.4 Equivalence Relations: 1-3, 6, 7, 9, 16, 17, 23, 24, 28, 33
- Section 5.1 Equinumerous Sets: 1, 2, 3, 5, 6, 7, 13
- Section 5.2 Finite Sets: 2, 7, 8, 9, 10, 19
- Section 5.3 Denumerable Sets: 7, 8, 9, 14, 15, 16, 17
- Section 5.4 Uncountable Sets: 1, 3, 5, 7, 10
- Section 6.1 Combinatorics: 1, 3, 5, 7-11, 15, 16, 17
- Section 6.2 Permutations and Combinations: 2, 4, 6-12, 14
- Section 6.3 Binomial Theorem: 3, 5, 11, 15, 16
- Section 4.5 Natural/Rational Numbers: 1, 2, 8, 10, 11
- Sections 4.6 Real/Complex Numbers: 1, 2, 3, 19, 20