

MATH 3311, INTRODUCTION TO DISCRETE MATHEMATICS AND COMBINATORICS

Fall Semester, 2014

Mathematics Department, Dr. Evelyn Potter, Department Chair

COURSE DESCRIPTION

This course introduces students to elements of combinatorics, number theory, and discrete structures. Topics covered include permutations, combinations, prime factorizations, the Euclidean Algorithm, relations, the pigeonhole principle, inclusion and exclusion, and finite state machines. It exposes students to areas of mathematics of current practical interest and involves the use of proof and algorithmic thinking.

COURSE SEQUENCE IN CURRICULUM

This course is a prerequisite for MATH 4310

PRE-REQUISITE INFORMATION

MATH 1451; MATH 3301 is highly recommended

INSTRUCTOR INFORMATION

Name: Evelyn Potter
E-mail: epotter@hbu.edu
Office Phone: 281-649-3785
Office Location: N210
Office Hours: MW 10:00 am – 11:00 am; Thurs 12:30-1:30 pm
or by appointment
Web Page Address, Web Board, ListServ: Blackboard

LEARNING RESOURCES

Course Text: Discrete Mathematics – 1st edition Kevin Ferland ISBN 0618415386, 2009.
Laboratory Text: None
Supplementary Text: None
Other Required Materials: TI 83 graphing calculator (or higher)

COURSE OBJECTIVES

Purpose of the course:

Students should become familiar with the area of mathematics known as discrete mathematics: number theory, graph theory, combinatorics. Also, students will be guided to use this knowledge in simple computer applications.

Aims for the course:

This course is meant to give math majors and students preparing to be math teachers the basic knowledge and skills of discrete mathematics. Most of the topics are suitable (some maybe in simpler versions) for the high school curriculum. This class is also meant to reinforce students' understanding of mathematical proof and rigorous analytic thought.

On completion of this course, students should be able to:

1. be familiar with the basic ideas in number theory; understand the connections between them and apply the knowledge to applications
2. be familiar with the basic concepts and facts in combinatorics and use counting techniques in different theoretical applications
3. be familiar with the basic concepts in graph theory; understand the need and power of graphs as modeling tools
4. be familiar with simple computer applications based on the topics described above
5. be able to present correct and coherent math proofs of subjects from discrete math to an audience

RELATION TO DEPARTMENTAL GOALS AND PURPOSES

The Mathematics/Physics Department "...will offer an academically rigorous, undergraduate curriculum in classical and modern mathematics. The curriculum will prepare students majoring in mathematics and mathematical studies for careers and further education in mathematics and will encourage a lifetime of learning."

"...will provide academically rigorous and modern courses in mathematics to support other programs at the University."

"...will offer courses to enable all graduates of the University to become mathematically literate and develop useful skills in mathematics."

"...will provide the appropriate administrative processes, facilities, research experiences, and faculty to achieve the goals stated above."

RELATION TO COLLEGE GOALS AND PURPOSES

"...to prepare students for careers and further education in the natural sciences and mathematics in a nurturing Christian environment. The College will also serve the HBU community by providing science and mathematics classes that empower HBU students to meet the goals and requirements of their field of study and enrich their liberal arts education."

RELATION TO THE PURPOSE STATEMENT OF THE UNIVERSITY

University mission and purpose statement from the Houston Baptist University Catalog, 2009-2010: "...to provide a learning experience that instills in students a passion for academic, spiritual, and professional excellence as a result of our central confession, "Jesus Christ is Lord"

"...Committed to providing a responsible and intellectually stimulating environment that:

- fosters spiritual maturity, strength of character, and moral virtue as the foundation for successful living
- develops professional behaviors and personal characteristics for life-long learning and service to God and to the community
- meets the changing needs of the community and society
- remains faithful to the '**Nature of the Institution**' statement"

"...Promotes learning, scholarship, creative endeavor, and service".

ATTENDANCE

Please see the official Attendance Policy in the HBU Classroom Policy on Blackboard. Students missing more than 25% of the class will be given a failing grade.

ACADEMIC ACCOMODATIONS

Students needing learning accommodations should inform the professor immediately and consult the Academic Accommodations section of the HBU Classroom Policy posted on Blackboard.

COURSE REQUIREMENTS & GRADE SCALE

Course requirements:

Calculators: Calculators will be allowed on some quizzes and exams, but not on others, consistent with the subject matter being tested

Homework: Homework will be assigned regularly, and represents the minimum number of problems you should be able to solve. Homework will be collected each week and students should be prepared to present their solutions to problems each day. Answers to problems should be in complete sentences which explain your solution. In some instances homework will be used to introduce concepts not discussed in class. **No homework will be accepted after attendance has been taken. The lowest 2 homework grades will be dropped.**

Quizzes: Quizzes may be given **with or without advance notice**. The quizzes will cover topics from the homework problems and from example problems discussed in class.

Exams: Two exams and a comprehensive final exam will be given. The exams will cover topics from the homework problems and from example problems discussed in class.

Class participation: Active participation in class is encouraged and expected. Students will volunteer or be called upon to present problems.

Questions on grading: Questions on the grading of a homework, quiz or exam must be raised within a week after the graded it is returned. Otherwise, questions on grading will not be entertained.

Grading standards:

Course grading is as follows:

Quizzes & Homework	100
Presentations & Participation	100
Exams)	200
<u>Final</u>	<u>200</u>
TOTAL Points	600

The grading scale is:

Assignment of final grade:

- A: 90% or greater
- B: 80% or greater and less than 90%
- C: 70% or greater and less than 80%
- D: 60% or greater and less than 70%
- F: less than 60%

PROFICIENCIES:

Technology component:

Students will use graphing calculators and the mathematics software Maple, as well as Microsoft Word and Excel. Also, the Internet will be used as a research tool.

Designated essay/writing component:

All homework assignments require detailed, coherent and complete written solutions; some problems will involve writing essay-type paragraphs.

Reading component:

Students are required to read the textbook as well as other recommended materials.

Oral communication component:

Oral presentations are required, and discussions related to materials presented by classmates are encouraged.

Mathematics component:

Entire course.

Critical thinking component:

Students are required to read, understand and analyze problems, develop solution strategies, implement these strategies to solve the problems, then interpret and verify their results.

LATE WORK & TEST POLICY

Late work:

Late homework will not be accepted.

Missed tests:

No makeup exams will be given. The final exam grade will (also) be used to replace the grade of any one exam missed due to a verifiable, excused absence. If additional tests are missed for excused absences, then a makeup exam will be given. All absences are considered unexcused unless documentation is provided.

Missed classes:

Students may accumulate at most three unexcused absences without any penalty. For each additional unexcused absence, a penalty of 2.0 points will be deducted from the final average obtained in the class.

EVALUATION

Method of student appraisal of faculty:

Students will be given an opportunity to appraise the professor by completing the IDEA Faculty Evaluation Questionnaire, and/or the COSM course evaluation at the end of the semester. The instructor, the department chairman and dean will review the responses of the students after the completion of the course.

Method of evaluating student response to course:

Students will be given an opportunity to describe their response to the course by completing the IDEA Faculty Evaluation Questionnaire and/or the COSM course Evaluation at the end of the course. The instructor, the department chairman and dean will review the responses of the students after the completion of the course.

LABORATORY DRESS CODE

Students may be asked in advance to wear closed-toed shoes and long pants during certain experimental procedures.

LABORATORY CONDUCT AND SAFETY

Not applicable.

TOPICAL OUTLINE - *include table, calendar, or topical outline with dates*

Topics Covered:

We will study topics selected from the following list.

1. Proof by Induction
2. Divisibility
3. The Euclidean algorithm
4. Fundamental Theorem of Arithmetic; applications
5. Congruences; linear congruences equations
6. Polynomial congruences
7. Number patterns
8. The fundamental principle of counting
9. A formula for the binomial coefficients
10. Combinatorics with indistinguishable objects
11. Intro to graphs: definitions, examples, subgraphs, complements and graph isomorphisms
12. Matrices, digraphs and relations
13. Vertex degrees: Euler’s trails and circuits
14. Hamilton paths and cycles
15. Trees: definitions, examples, properties
16. Rooted trees
17. Trees and sorting
18. Weighted trees and prefix codes*
19. Optimization and matching*
20. Finite state machines*
21. Sequences: an introduction
22. Pascal’s triangle
23. The Fibonacci numbers
24. The golden ratio
- 25.

Week1 8/25 Introduction	Chapter 3&4	Euclidean Algorithm
Week 2 9/1	Chapter 3&4	Induction
Week3 9/8	Chapter 5	Relations
Week 4 9/15	Chapter 5	Relations
Week 5 9/22		EXAM 1
Week 6 9/29	Chapter 6	Counting
Week 7 10/6	Chapter 6	
Week 8 10/13	Chapter 7	
Week 9 10/20	Chapters 7	More Counting
Week 9 10/27	EXAM II	
Week 10 11/3 Orders	Chapter 8	Graph Theory

Week 11 1/10 Finite State Machines 3	Chapter 8	
Week 12 Test II 11/117 Subgraphs	Chapter 9	Graph Properties
Week 13 11/124	Chapter 10	Thanksgiving
Week 14 12/1 Coloring Graphs		Trees and Algorithms

The content of this outline and the attached schedule are subject to change at the discretion of the professor.

Student Signature – I have read and understand the syllabus for this class. I understand that the content of this syllabus and the topical outline are subject to change at the discretion of the professor. I have read and understand the HBU Classroom Policy posted on Black Board. **I promise to uphold the Code of Academic Integrity at Houston Baptist University and will not tolerate its violation by others.**