Math 104: Finite Mathematics

Guangyue Han

Electronic Information Resource:

Electronic version of this sheet about this course and some updated information will be found on the Web at http:// www.nd.edu/~ghan.

Textbook:

L. J. Goldstein, D. I. Schneider, and M. J. Siegel, Finite Mathematics and its Applications, 7ed, Prentice-Hall 2001.

Course Goals:

People are living in real world and are interacting with real life things around them every day. Different persons may have different points of view towards exactly the same thing from various perspectives. The mathematical way of thinking empowers the human intellect, enhances critical thinking and facilitates rational decision making.

This course is really about to give an brief introduction to the "non-math" people about mathematics. Mathematics comes from the real world. "Point", "line", "linear equation", "probability"..., we can find their counterparts in the real world. However mathematics lies above the real world and shows its power by making appropriate abstraction, therefore a point is "something" which has no volume, but it represents a whole lot of "small" and "round" stuff! You will never see what the probability is although you can sense one thing happens more often than the other! What are people studying in mathematics? How will one form a mathematical way of thinking? How does mathematics come from the real world and how one can apply mathematics back to real life. You will find your own answer in this course.

Course Content:

We will start off the whole exploration with chapter 1: **Linear Equations and Straight Lines**. Linear equation is the simplest relationship between two variables and we can find many applications in every day life. Linear equation can be viewed as a mathematical formulation of the straight lines we see everyday. On the other hand a straight line can be a very helpful visualization of a linear equation.

We will be concerned with solving systems of linear equations in the chapter 1, it is a little annoying to keep writing all the variables when we are solving the equations. How about if we just drop all the variables? Good idea! We get **matrices**. As time goes along we will find more interesting aspects about matrix. We will find Gauss-Jordan method can mysteriously derive the inverse of a matrix, which really means we can solve the corresponding linear equation.

We are going to deal with **optimization** problems with linear constraints and linear target in chapter 3. You will find that graphing a linear equation (we study this in chapter 1) is so powerful. By doing so, we convert a lot of real life problems into drawings and calculatings on a piece of paper. Just imagine that you can tell a politician how he can allocate his campaign resources (see problem 8 on page 118 of the textbook).

The journey to "uncertain" world will begin with chapter 5. In this chapter we will study **sets and counting**. General principles about sets and counting will be introduced and as

you can see they can be justified by very direct intuition. Maybe when you are learning Venn diagram, you realize all of a sudden: 'Gosh, I used this diagram when I was a child!'

Uncertainty happens all over around us every day and many events in the world exhibit a random character. "What is the chance of getting a head when an even coin is flipped?" This is a **probability** problem. "What can you say about a coin if you only get 3 tails after you flip a coin 1000 times?" This would a problem in **statistics**. In chapter 6 and chapter 7 we will be dealing with a lot of such kind of interesting uncertain problems.

Yes! You did it before: draw some points on the board and connect them with line segments. They are called **graph** in the mathematical world. Why mathematicians are studying seemingly so simple stuff? Well right now just tell you one thing: Euler solved the very famous Konigsberg 7 bridge problem with a simple graph (see page 599 in the textbook).

When you are listening to a mp3 file or a music CD, you are using them. When you are browsing the internet using a Dell computer, you are using them. When you are taking cash from Notre Dame Federal Credit Union, you are using them too. They are everywhere in this digital world: **coding theory and cryptography**. We will have a short trip to this wonderful digital world. How to design a error-correcting code such ISBN and how to cipher and decipher your important messages will be concerning us.

Brief Schedule

	Date	Day	Time	Room	Points
Midterm 1	Feb 6	Friday	in class	in class	100
Midterm 2	Mar 5	Friday	in class	in class	100
Midterm 3	Apr 7	Wednesday	in class	in class	100
Final Exam	May 6	Thursday	1:45PM-3:45PM	118 Nieuland	150
Homework	assigned daily and collected weekly				50
Total Points: 500					

Class Attendance:

A first year student who accumulates more than 3 unexcused absences may be give an F.

Homework:

Homework problems will be assigned daily and collected weekly. **Never copy other people's homework!** Always do your homework on your own. Many times you may think you understand what the lecturer said in the class or what is written in the textbook. However the only way to truly grasp and master the contents is to do the exercises with your own thinking. You are encouraged to discuss with your classmates, our teaching helping assistant, or the lecturer about the homework, finishing the homework and understanding what has been taught must be your own work.

Study Help:

Note that there will be a help session holding by an assistant (when and where and who TBA). You can also sign up to obtain valuable assistance from **Learning Resources Center (LRC)** for study help.

You can always make appointment with me by email (ghan@nd.edu) for study help, or you can also visit me in my office (Hurley 235) without making appointment during my office hour (TBA). Before every exam I will annouce extra office hours to answer questions.

Exams:

Note that there will be three Midterm Exams and a Final Exam. A student who misses an examination will receive zero points for that exam unless he or she has written permission from the Dean of the First Year of Studies. Please be aware that travel plans, sleeping in, defective alarm clock etc are not considered to be a valid excuse by the Dean of the First year of Studies. If you have a valid excuse (illness, excused athletic absence etc) for missing an exam, please see your instructor ASAP (preferably before the exam) and a makeup exam will be scheduled.

Students with more than 2 finals in one day, or more than 3 finals in a 24 hour period, may negotiate to change the time of one of these finals. If you intend to request to have the time of this class changed, please talk to the lecturer before April 15th.

Detailed Schedule:

1.1 Coordinate Systems and Graphs
1.2 Linear Inequalities
1.3 The Intersection Point of a Pair of Lines
1.4 The Slope of a Straight Line
2.1 Solving Systems of Linear Equations, I
2.2 Solving Systems of Linear Equations, II
2.3 Arithmetic Operations on Matrices
2.4 The Inverse of a Matrix
• Review

Midterm 1

3.1 A Linear Programming Problem
3.2 Linear Programming I
3.3 Linear Programming II
5.1 Sets
5.2 A Fundamental Principle of Counting
5.3 Venn Diagrams and Counting
5.4 The Multiplication Principle
• Review

Midterm 2

6.1 Introduction to Probability
6.2 Experiments, Outcomes, and Events
6.3 Assignment of Probabilities
6.4 Calculating Probabilities of Events
6.6 Tree Diagrams
6.7 Bayes' Theorem
7.1 Visual Representation of Data
7.2 Frequency and Probability Distributions
• Review

Midterm 3

7.4 The Mean
7.5 The Variance and Standard Deviation
13.1 Graphs as Models
13.2 Paths and Circuits
ISBN number, ASCII code and simple Hamming code
Caesar cipher, Vigrene cipher, Hill cipher, and RSA
• Review

Final Exam