Discrete Mathematics

Moshe Rosenfeld
University of Washington
Tacoma Washington, USA
moishe@u.washington.edu

1 Introduction

In 1623 **Galileo Galilei** wrote:

‘‘The universe cannot be read until we have learnt the language and become familiar with the characters in which it is written. It is written in mathematical language... without which means it is humanly impossible to comprehend a single word"

So what is Mathematics?

One classical definition is:
"Mathematics is the study of numbers, shapes and patterns."

I also like the following quote by Sun-Yung Alice Chang Professor of Mathematics, Princeton University:

"Mathematics is a language like music. To learn it systematically, it is necessary to master small pieces and gradually add another piece and then another. Mathematics is like the classical Chinese language - very polished and very elegant. Sitting in a good mathematics lecture is like sitting in a good opera. Everything comes together."

So where does Discrete Mathematics fit in?

According to Wikipedia: "discrete mathematics is the study of mathematical structures that are fundamentally discrete rather than continuous." More formally, discrete mathematics has been characterized as the branch of mathematics dealing with countable sets. However, there is no exact, universally agreed, definition of the term **"discrete mathematics."**

Cryptology based on number theory, linear programming, computing theory, scheduling are some examples of very important modern applications of mathematics. Most of the mathematics used in these applications is Discrete

Mathematics.

So rather than spending time to try and define or describe what Discrete Mathematics is, let us talk about what we will try to learn.

We will look at logic, elementary set theory, combinatorics, number theory, and graph theory. We shall see how these topics are used in related applications. The heart and soul of mathematics is the ***Proof***. In almost all instances, proofs of theorems will be provided.

1.1 Class work

We shall try to emphasize *explorations and discovery*. To implement this we shall use the mathematical package SAGE developed at the University of Washington.

Class presentations will be a mixture of blackboard and Power Point slides. Slides used in class will be posted on the class web site:

http://www. faculty.washington.edu/moishe/hanoi-2011/DiscreteMathematics

The file **lecturenotes.pdf** in the class web site will include further information, announcements and background review material.

Your grade will be determiend as follows:

1. Assignments:15%
2. Mid Term: 35%
3. Final: 50%

Office hours
My office is in T3 office number 406.
Office hours:
Tuesday: 1:00 - 2:30
Thursday: 1:00 - 2:30

Please feel free to stop by any time.

There are many textbooks for Discrete Mathematics. Below please find a small list of books. A large part of the material covered in this class can be found in Rosen's book. We have two copies of Rosen's book (6^{th} and 7^{th} editions) in the department and other books. We want to express our thanks to the Vietnam Education Foundation and to the donors who helped us aquire these books.

1. Discrete Mathematics and Its Applications, 7th edition, K.H. Rosen, McGraw Hill, 2011. Web site: http://www.mhhe.com/math/advmath/rosen/

2. Discrete and Combinatorial Mathematics (an Applied Introduction) 4th Edition, R. P. Grimaldi, Addison-Wesley, 1999

3. Concrete Mathematics, R.L.Graham, D.E.Knuth and O. Patashnik, Addison-Wesley

4. Invitation to Discrete Mathematics, J. Matousek and J. Nesetril, OXFORD

5. A course in Combinatorics, J.H. Van Lint and R. M. Wilson

1.2 Topics

1. Logic.

2. Sets.

3. Counting.

4. A sample of scheduling problems.

5. Modular arithmetic

6. Sselected topics in graph theory.

Al topics will include examples of related applications.