Goals of a Discrete Mathematics Course

A discrete mathematics course has more than one purpose. Students should learn a particular

set of mathematical facts and how to apply them; more importantly, such a course should teach

students how to think logically and mathematically. To achieve these goals, this text stresses

mathematical reasoning and the different ways problems are solved. Five important themes

are interwoven in this text: mathematical reasoning, combinatorial analysis, discrete structures,

algorithmic thinking, and applications and modeling. A successful discrete mathematics course

should carefully blend and balance all five themes.

1 . Mathematical Reasoning: Students must understand mathematical reasoning in order to

read, comprehend, and construct mathematical arguments. This text starts with a discussion

of mathematical logic, which serves as the foundation for the subsequent discussions of

methods of proof. Both the science and the art of constructing proofs are addressed. The

technique of mathematical induction is stressed through many different types of examples

of such proofs and a careful explanation of why mathematical induction is a valid proof

technique.

2 . Combinatorial Analysis: An important problem-solving skill is the ability to count or enumerate

objects. The discussion of enumeration in this book begins with the basic techniques

of counting. The stress is on performing combinatorial analysis to solve counting problems

and analyze algorithms, not on applying formulae.

3 . Discrete Structures: A course in discrete mathematics should teach students how to work

with discrete structures, which are the abstract mathematical structures used to represent

discrete objects and relationships between these objects. These discrete structures include

sets, permutations, relations, graphs, trees, and finite-state machines.

4. Algorithmic Thinking: Certain classes of problems are solved by the specification of an

algorithm. After an algorithm has been described, a computer program can be constructed

implementing it. The mathematical portions of this activity, which include the specification of

the algorithm, the verification that it works properly, and the analysis ofthe computer memory

and time required to perform it, are all covered in this text. Algorithms are described using

both English and an easily understood form of pseudocode.

5. App lications and Modeling: Discrete mathematics has applications to almost every conceivable

area of study. There are many applications to computer science and data networking in

this text, as well as applications to such diverse areas as chemistry, botany, zoology, linguistics,

geography, business, and the Internet. These applications are natural and important uses

of discrete mathematics and are not contrived. Modeling with discrete mathematics is an

extremely important problem-solving skill, which students have the opportunity to develop

by constructing their own models in some of the exercises.