

# Preface

**Note.** Russell Merris' *Combinatorics* Second Edition (NY: John Wiley & Sons, 2003) is (see page *ix*) “intended to be used as the text for a course in combinatorics at the level of beginning upper division students.” So the intended audience is a junior or senior math or computer science major. Thus, this book is ideal for Applied Combinatorics and Problem Solving (MATH 3340).

**Note.** A foundation of the material is given in Chapter 1, “The Mathematics of Choice,” and Chapter 2, “The Combinatorics of Finite Functions.” These two chapters together cover over 170 pages of the book. Chapter 1 concentrates on combinations and counting. Chapter 2 continues with counting, but shifts to the topics of probability and algebraic applications.

**Note.** Chapter 3, Pólya's Theory of Enumeration, covers some topics you will also see in Introduction to Modern Algebra (MATH 4127/5127), including permutation groups and symmetry groups. Chapter 4, Generating Functions, uses functions and recursion for enumeration (the Fibonacci sequence is considered here, for example). Chapter 5, Enumeration in Graphs, covers some topics you will also see in [Introduction to Graph Theory \(MATH 4347/5347\)](#) but related to counting. Chapter 6, Codes and Designs, give a quick (i.e., 26 page) introduction to coding theory and a quick (i.e., 30 page) introduction to design theory. Chapters 3 through 6 are independent of each other and can be covered as desired.

**Note.** The formal prerequisite for Applied Combinatorics and Problem Solving (MATH 3340) is **Mathematical Reasoning (MATH 3000)**. However, you will also need a knowledge of partial fractions and Maclaurin series (covered in **Calculus 2**), and elementary row operations, determinants, and inverse matrices (covered in **Linear Algebra**).

**Note.** Merris admits on page *xi* that “[t]he book contains much more material than [sic] can be covered in a single semester.” He then proposes the following coverage in a class such as this one:

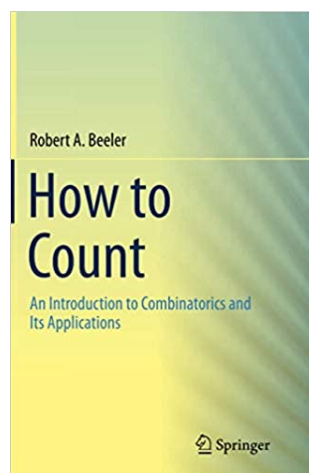
- Chapters 1, 2, and 4 and Sections 3.1–3.3.
- Chapters 1 (omitting the optional Sections 1.3, 1.4, and 1.10), 2, and 3, and Sections 5.1 and 5.2.
- Chapters 1 (omitting the optional Sections 1.3 and 1.10), 2 and and Sections 4.1–4.4.
- Chapters 1 (omitting the optional Sections 1.4 and 1.10) and 2 and Sections 3.1–3.3, 4.1–4.3, and 6.3.
- Chapters 1 (omitting optional Sections 1.3 and 1.4) and 2 and Sections 4.1–4.3, 5.1, and 5.3–5.7.
- Chapters 1 (omitting the optional Sections 1.3, 1.4, and 1.10) and 2 and Sections 4.1–4.3, 5.1, 5.3–5.5, and 6.3.

Given your instructor’s preferences (and the catalog description), the material in Chapters 1 and 2 (containing basic information), parts of Chapter 3 (involving applications of abstract algebra), Chapter 4 (containing generating functions and

recursion, as mentioned in the catalog description), and the design theory part of Chapter 6 (namely, Sections 6.3 and 6.4) would constitute an excellent (though lengthy) version of this class. This omits the material of Chapter 5 entirely (important material, but material covered in [Introduction to Graph Theory \[MATH 4347/5347\]](#)).

**Note.** The Preface of the book (copyright 2003) also mentions a webpage containing corrections to the book. Unfortunately, this is no longer available and the website is not active. Professor Russell Merris is now an emeritus professor of the California State University-East Bay in Hayward, California. There is a [website for him as an emeritus professor on the CSU-East Bay](#) (accessed 1/4/2022).

**Note.** A viable alternative to Merris' *Combinatorics* is *How to Count: An Introduction to Combinatorics and Its Applications* (Springer, 2015) by my ETSU colleague, [Robert A. Beeler](#). When we offer Applied Combinatorics and Problem Solving (MATH 3340), it is likely that it will be taught by Dr. Beeler and that he will use his own book. These online notes are largely meant for self-study and reference.



*Revised: 1/9/2022*