

# 151 Discrete Mathematics

K. Rosen, Discrete Mathematics and Its Applications, 7th edition

## Chapter 1 The Foundations: Logic and Proofs

### 1.1. Propositional Logic

Ex.1, Ex.2, Def.1, Ex.3, Ex.4, Def.2, Ex.5, Def.3, Ex.6, Def.5, Ex.7, converse, contrapositive, inverse, Def.6, Ex.10, Ex.11, precedence of logical operators.

### 1.3. Propositional Equivalences

Def.1, Ex.1, Def.2, Ex.2, Ex.3, Ex.4, Table 6, Table 7, Table 8, Ex.5, Ex.6, Ex.7, Ex.8.

### 1.4. Predicates and Quantifiers

Ex.1, Ex.2, Ex.3, Ex.4, Ex.5,  $P(x_1, x_2, \dots, x_n)$ , Def.1, Ex.8, Ex.9, Ex.10, Ex.11, Ex.13, Def.2, Ex.14, Ex.15, Ex.16, Ex.17, negating expressions, Table 2, Ex.21, Ex.22.

### 1.6. Rules of Inference

Def.1, Ex.2. Write the followings using the argument form and check if the argument is valid: Ex.3, Ex.4, Ex.5, Ex.6, Ex.7, Ex.8, Ex.9, Ex.10, Ex.11.

### 1.7. Introduction to Proofs

Def.1, Ex.1, Ex.2, Ex.3, Ex.4, Ex.5, Ex.6, Def.2, Ex.7, Ex.8, Ex.10, Ex.11, Ex.12, Ex.13, Ex.14, Ex.15, Ex.18.

### 1.8. Proof Methods and Strategy

Ex.1, Ex.3, Ex.4, Ex.6, Ex.7, Ex.9, Ex.10, Ex.13, Ex.17.

## Chapter 2 Basic Structures: Sets, Functions, Sequences, Sums, and Matrices

### 2.1. Sets

Def.1, Ex.1, Ex.2, Ex.3, Ex.4, definitions for  $\mathbb{N}$ ,  $\mathbb{Z}$ , etc., definitions for intervals, Def.2, Ex.6, Ex.7, Def.3, Ex.8, Ex.9, Th.1(no proof), Def.4, Ex.10, Def.5, Ex.13, Def.6, Ex.14, Ex.15, Def.8, Ex.17, Ex.18, Ex.20.

### 2.2. Set Operations

Def.1, Ex.1, Def.2, Ex.3, Def.3, Ex.5, Def.4, Ex.6, Def.5, Ex.9, Table 1, Def.6, Def.7, Ex.15.

## Chapter 5 Induction and Recursion

### 5.1. Mathematical Induction

Ex.1, Ex.2, Ex.3, Ex.4, Ex.5, Ex.6, Ex.8, Ex.11.

### 5.2. Strong Induction and Well-Ordering

Ex.2.

**Q.1.** Let  $\{a_n\}$  be a sequence defined inductively as:

$$a_1 = 1, a_2 = 2, a_{n+1} = 2a_n + a_{n-1}, \quad \forall n \geq 2.$$

Prove that  $a_n \leq \left(\frac{5}{2}\right)^n$ , for all  $n \geq 2$ .

## Chapter 9 Relations

### **9.1. Relations and Their Properties**

Ex.2, Ex.3, Def.2, Ex.4, Ex.5, Def.3, Ex.7, Ex.8, Ex.9, Def.4, Ex.10, Ex.11, Ex.12, Def.5, Ex.13, Ex.14, Ex.15, Ex.17, Ex.18, Ex.19, Def.6, Ex.20, Ex.21, Def.7, Ex.22, Th.1 (no proof).

### **9.3. Representing Relations**

Def.1, Ex.7, Ex.8, Ex.9, Ex.10.

### **9.4. Closures of Relations**

Ex.1, Ex.2, Def.2, Th. 2(without proof).

**Q.1.** If  $R = \{(1, 1), (2, 1), (3, 2), (4, 3)\}$  is a relation on the set  $A = \{1, 2, 3, 4\}$ , find  $R^*$ .

### **9.5. Equivalence Relations**

Def.1, Def.2, Ex.1, Ex.2, Ex.3, Ex.6, Ex.7, Def.3, Ex.8, Ex.9, Th.1 (no proof), Ex.12, Ex.14.

### **9.6. Partial Orderings**

Def.1, Ex.1, Ex.2, Ex.3, Ex.4, Def.2, Ex.5, Def.3, Ex.6, Ex.7, Hasse diagrams, Ex.12, Ex.13.

## **Chapter 10 Graphs**

### **10.1. Graphs and Graph Models**

All until graph models (which is not included).

### **10.2. Graph Terminology and Special Types of Graphs**

Def.1, Def.2, Def.3, Ex.1, Th.1, Ex.3, Th.2 (no proof), Def.4, Ex.5, Ex.6, Ex.7, Def.6, Ex.9, Ex.10, Ex.11, Ex.13, Def.7, Def.8, Ex.18, removing vertices from a graph.

### **10.3. Representing Graphs and Graph Isomorphism**

Ex.1, Def.1, Ex.8, Ex.9, Ex.10.

### **10.4. Connectivity**

Def.1, Ex.1, Def.2, Def.3, Ex.4, Th.1 (no proof), Ex.5.

### **10.7. Planar Graphs**

Def.1, Ex.1, Ex.3, Th.1 (no proof), Ex.4, Cor.1 (no proof), Cor.2 (no proof), Ex.5, Cor.3, Ex.6.

## **Chapter 11 Trees**

### **11.1. Introduction to Trees**

Def. 1, Ex.1, Th.1(no proof), Def. 2, Ex.2, Def.3, Ex.4, Th.2(no proof), Ex. 10, Ex. 11.

### **11.2. Applications of Trees**

Ex.1.

### **11.4. Spanning Trees**

Def.1, Ex.1.

## **Chapter 12 Boolean Algebra**

### **12.1. Boolean Functions**

Ex.1, Ex.2, Ex.3, Ex.4, Ex.5, Ex.8, Table 5, Ex.9, Ex.10, Ex.11, Ex.12, Def.1.

### **12.2. Representing Boolean Functions**

Ex.1, Ex.2, Ex.3, Def.1, only the definition of sum of products; functional completeness is not included.

### **12.3. Logic Gates**

All section, except Ex.2 and adders.

### **12.4. Minimization of Circuits**

Ex.1, Ex.2, Ex.3, Ex.4 and all definitions up to pag. 835.