151 Math Exercise Sheet
Discrete Mathematics and its Applications
K. Rosen, 7th Edition, E-Book version

Chapter 1: The Foundations: Logic and Proofs

Section	Required Exercises
1.1 **Propositional Logic**	**2,3,8(a,d,g),11(a,c,e),17,28,29(a,c),31(c,e), 35(e),40.**
1.3 **Propositional Equivalences**	**1(a),3(a),7,9(c),10(c),11,12,14,16,19.**
1.4 **Predicates and Quantifiers**	**1,5,7,11,14,15,19.**
1.6 **Rules of Inference**	**1,2,and The sheet below**
1.7 **Introduction to Proofs**	**1,3,6,9,11,15,16,17,26,31.**
1.8 **Proof Methods and Strategy**	**1,3,6,9,14,19,29,34.**

Section 1.6
Are the following arguments valid or invalid?

$p \vee r$ $r \rightarrow q$ $s \vee \neg q$ $\neg s$ ――― $\therefore p$	$p \rightarrow q$ $\neg q$ $p \vee s$ ――― $\therefore s$
$(q \vee r) \rightarrow p$ $\neg p$ $s \rightarrow r$ ――― $\therefore \neg s$	$p \rightarrow q$ $\neg p \rightarrow r$ $r \rightarrow s$ ――― $\therefore \neg q \rightarrow s$
$\neg p \rightarrow (p \vee r)$ $\neg q \rightarrow (\neg p \wedge s)$ $s \rightarrow q \vee r$ ――― $\therefore q$	$p \rightarrow (q \rightarrow r)$ $r \rightarrow \neg u$ $\neg s \rightarrow u$ ――― $\therefore q \rightarrow (p \rightarrow u)$

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Chapter2:Basic Structures: Sets, Functions, Sequences, Sums and Matrices

2.1 **Sets**	**1,2,3,5,7,8,10,19,27(a)**
2.2 **Set Operations**	**4,14,25,28**

Chapter 5:Induction and Recursion

5-1 **Mathematical Induction**	**4-5-6-8-9-12-18-20-28-31-32-38-39-43**
5-2 **Strong Induction and Well-Ordering**	**Q1: Let $\{a_n\}$ be a sequence of integers defined inductively as:** $a_1 = 1,\ a_2 = 5, a_{n+1} = 2a_n + 3a_{n-1}\ for\ all\ n \geq 2.$ **Prove that** $3^n \leq a_{n+1} \leq 2(3^n)\ \ for\ all\ n \geq 1.$ **Q2: Let $\{a_n\}$ be a sequence of integers defined inductively as:** $a_1 = a_2 = a_3 = 1, a_{n+2} = a_{n+1} + a_n + a_{n-1}\ \ for\ all\ n \geq 2.$ **Prove that** $a_n\ is\ an\ odd\ number\ for\ all\ n \geq 1.$ **Q3: Let $\{a_n\}$ be a sequence of integers defined inductively as:** $a_0 = 1, a_{n+1} = a_n + 3^n\ \ for\ all\ n \geq 0.$ **Prove that** $a_n = \frac{1}{2}(3^n + 1)\ \ for\ all\ n \geq 0.$

Chapter 9:Relations

9.1 **Relations and their Properties**	**1,3,6,10,11,18,26,30,32,34(a,d,e)- 36(d,e,h) ,41 ,50 ,51,52,53,56.**
9.3 **Representing Relations**	**18,22,24,26,27, 31,32.**
9.4 **Closures and Relations**	**1,2,4,5,6,8,9,19,22,24,29.**
9.5 **Equivalence Relations**	**1,3,9,16,21,22,23,26,28,36,40(a),42,46,48(a),55, 56(a,b).**
9.6 **Partial Ordering**	**1,6,9,10,11,14,20,22.**

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Chapter10: Graphs

10-1 **Graphs and Graph Models**	**3,4,5,6,7,8,9,10**
10-2 **Graph Terminology and Special Types of Graphs**	**1,2,3,4,5,6,20(a,b,c,d),21, 22, 23, 24, 25, 26(a,b), 35, 36,37,38,39,40,41, 48,49,59(a,b),60.**
10-3 **Representing Graphs and Graph Isomorphism**	**34,35,36,37,38,39,50,51,53,54,55.**
10-4 **Connectivity**	**1,2,3,4,5,6.**
10-7 **Planar Graphs**	**1,2,3,4,5,6,7,8,9,12,13,14.**

Chapter11Trees

11.1 **Introduction to Trees**	**2,4,6,8,10,16,17.**
11.2 **Application of Trees**	**1,2**
11.4 **Spanning Trees**	**2,3,4,5,6,7,8**

Chapter12Boolean Algebra

12-1 **Boolean Functions**	**1,2,3,4,5(b,d),6(c,d),11,28**
12-2 **Representing Boolean Functions**	**1(b,c,d),2(a,d),3(a,d),7(c)**
12-3 **Logic Gates**	**1,2,3,4,5,6**
12-4 **Minimization of Circuits**	**1,2,3,4(c),6(a,b),12,13 ,14.**