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| **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.** |

**Chapter 1: The Foundations: Logic and Proofs**

**Section 1.6**

**Are the following arguments valid or invalid?**

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| $\begin{matrix}p∨r\\r⟶q\\\begin{matrix}s∨¬q\\\begin{matrix}\begin{matrix}¬s\\\end{matrix}\\∴p\end{matrix}\end{matrix}\end{matrix}$ | $\begin{matrix}p\rightarrow q\\¬q\\\begin{matrix}p∨s\\\begin{matrix}\\∴s\end{matrix}\end{matrix}\end{matrix}$ |
| $\begin{matrix}\left(q∨r\right)\rightarrow p\\¬p\\\begin{matrix}s\rightarrow r\\\begin{matrix}\\∴¬s\end{matrix}\end{matrix}\end{matrix}$ | $\begin{matrix}p\rightarrow q\\¬p⟶r\\\begin{matrix}r\rightarrow s\\\begin{matrix}\\∴¬q\rightarrow s\end{matrix}\end{matrix}\end{matrix}$ |
| $\begin{matrix}¬p\rightarrow \left(p∨r\right)\\¬q\rightarrow \left(¬p∧s\right)\\\begin{matrix}s\rightarrow q∨r\\\begin{matrix}\\∴q\end{matrix}\end{matrix}\end{matrix}$ | $\begin{matrix}p\rightarrow \left(q\rightarrow r\right)\\r\rightarrow ¬u\\\begin{matrix}¬s\rightarrow u\\\begin{matrix}\\∴q\rightarrow \left(p\rightarrow u\right)\end{matrix}\end{matrix}\end{matrix}$ |

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

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| **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**

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| **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** $\left\{a\_{n}\right\}$ **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** $\left\{a\_{n}\right\}$ **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** $\left\{a\_{n}\right\}$ **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** $a\_{n}=\frac{1}{2}(3^{n}+1) for all n\geq 0.$ |

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| **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.** |

**Chapter 9:Relations**

**Chapter10: Graphs**

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| **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**

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| **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**

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| **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.** |