A solutions manual for Algebra by Thomas W. Hungerford

In 2017, for no special reason I started studying mathematics and writing a solutions manual for Algebra by Thomas W. Hungerford.

Introduction: Prerequisites and Preliminaries

7. The Axiom of Choice, Order and Zorn's Lemma
8. Cardinal Numbers *wip*

Chapter I: Groups

1. Semigroups, Monoids and Groups *wip*
2. Homomorphisms and Subgroups *wip*
3. Cyclic Groups *wip*
4. Cosets and Counting
5. Normality, Quotient Groups, and Homomorphisms
6. Symmetric, Alternating, and Dihedral Groups
7. Categories: Products, Coproducts, and Free Objects
8. Direct Products and Direct Sums
9. Free Groups, Free Products, Generators & Relations

Chapter II: The Structure of Groups

1. Free Abelian Groups
2. Finitely Generated Abelian Groups
3. The Krull-Schmidt Theorem
4. The Action of a Group on a Set
5. The Sylow Theorems
6. Classification of Finite Groups
7. Nilpotent and Solvable Groups
8. Normal and Subnormal Series

Chapter III: Rings

1. Rings and Homomorphisms
2. Ideals
3. Factorization in Commutative Rings
4. Rings of Quotients and Localization
5. Rings of Polynomials and Formal Power Series

6. Factorization in Polynomial Rings

Chapter IV: Modules

1. Modules, Homomorphisms and Exact Sequences
2. Free Modules and Vector Spaces
3. Projective and Injective Modules
4. Hom and Duality
5. Tensor Products
6. Modules over a Principal Ideal Domain
7. Algebras

Chapter V: Fields and Galois Theory

1. Field Extensions
2. The Fundamental Theorem
3. Splitting Fields, Algebraic Closure and Normality
4. The Galois Group of a Polynomial
5. Finite Fields
6. Separability
7. Cyclic Extensions
8. Cyclotomic Extensions
9. Radical Extensions

Chapter VI: The Structure of Fields

1. Transcendence Bases
2. Linear Disjointness and Separability

Chapter VII: Linear Algebra

1. Matrices and Maps
2. Rank and Equivalence
3. Determinants
4. Decomposition of a Single Linear Transformation and Similarity
5. The Characteristic Polynomial, Eigenvectors and Eigenvalues

Chapter VIII: Commutative Rings and Modules

1. Chain Conditions
2. Prime and Primary Ideals

3. Primary Decomposition
4. Noetherian Rings and Modules
5. Ring Extensions
6. Dedekind Domains
7. The Hilbert Nullstellensatz

Chapter IX: The Structure of Rings

1. Simple and Primitive Rings
2. The Jacobson Radical
3. Semisimple Rings
4. The Prime Radical; Prime and Semiprime Rings
5. Algebras
6. Division Algebras

Chapter X: Categories

1. Functors and Natural Transformations
2. Adjoint Functors
3. Morphisms