Mathematical Reasoning, Chapter 3 Study Guide

Chapter 3. Functions.

The following is a *brief* list of topics covered in Chapter 3 of Larry Gerstein's *Introduction to Mathematical Structures and Proofs*, 2nd edition. This list is not meant to be comprehensive, but only gives a list of several important topics.

3.1. Definitions and Examples.

Function between two sets, domain, codomain, image, preimage, a function transforms x to y, a function operates on its domain, mapping, transformation, inclusion mapping, well-defined function, equal functions, restriction of a function to a subset of the domain, extension of a function to a superset of the domain (Definition 3.6).

3.2. Surjections, Injections, Bijections, Sequences.

Range or image of a function, surjection/onto, injection/one-to-one, the "marriage problem," system of distinct representatives, Hall's Marriage Theorem, greedy algorithms, bijection/one-to-one correspondence, finite sequence/infinite sequence/sequence, length of a finite sequence, n-tuple, coordinate, a bijection from $\mathbb{N}$ to $\mathbb{N} \times \mathbb{N}$ (Example 3.18), an uncountable set (Example 3.19), Cantor diagonalization argument.

3.3. Composition of Functions.

Composition of two functions, projections (Example 3.21), Associativity Law of Function Composition (Theorem 3.23), compositions of injections/surjections/bijections (Theorem 3.24), a surjection from $\mathbb{N}$ to $\mathbb{Q}^+$ (Example 3.15), inverse function of a bijection, the inverse of a bijection is also a bijection, equivalent conditions for a function to have an inverse (Theroem 3.27), Cancellation Laws (Corollary 3.28), the inverse of a composition (Theorem 3.29).