Review Guide: Chapter 7

Definitions: How are the following terms defined?

- function f from a set X to a set Y *(p. 384)*
- Let f be a function from a set X to a set Y.
  - the domain, co-domain, and range of f *(p. 384)*
  - the image of X under f *(p. 384)*
  - the value of f at x, where x is in X *(p. 384)*
  - the image of x under f, where x is in X *(p. 384)*
  - the output of f for the input x, where x is in X *(p. 384)*
  - an inverse image of y, where y is in Y *(p. 384)*
  - the identity function on a set *(p. 387)*
  - the image of A, where $A \subseteq X$ *(p. 392)*
  - the inverse image of B, where $B \subseteq Y$ *(p. 392)*
- logarithm with base b of a positive number x *(p. 388)*
- Hamming distance function *(p. 389)*
- Boolean function *(p. 390)*
- one-to-one function *(p. 397)*
- onto function *(p. 402)*
- exponential function with base b *(p. 405)*
- one-to-one correspondence *(p. 408)*
- inverse function *(p. 411)*
- composition of functions *(p. 417)*
- cardinality *(pp. 428-429)*
- countable and uncountable sets.*(p. 431)*

General Function Facts

- How do you draw an arrow diagram for a function defined on a finite set? *(p. 384)*
- Given a function defined by an arrow diagram or by a formula, how do you find values of the function, the range of the function, and the inverse image of an element in its co-domain? *(p. 385)*
- How do you show that two functions are equal? *(p. 386)*
- In what way does a sequence define a function? *(p. 387)*
- Can you give an example of a function defined on a power set? a function defined on a Cartesian product? *(p. 387-388)*
- What is an example of an encoding function? a decoding function? *(p. 389)*
- If the claim is made that a given formula defines a function from a set X to a set Y, how do you determine that the "function" is not well-defined? *(p. 391)*

One-to-one and Onto

- How do you show that a function is not one-to-one? *(pp. 397-400)*
- How do you show that a function defined on an infinite set is one-to-one? *(pp. 399-400)*
- How do you show that a function is not onto? *(pp. 402-405)*
- How do you show that a function defined on an infinite set is onto? *(pp. 403-405)*
- How do you determine if a given function has an inverse function? *(p. 411)*

- How do you find an inverse function if it exists? *(pp. 411-413)*

Exponents and Logarithms

- What are the four laws of exponents? *(p. 406)*
- What are the corresponding properties of logarithms? *(p. 406)*
- How can you use the laws of exponents to derive properties of logarithms? *(p. 407)*
- How are the logarithmic function with base b and the exponential function with base b related? *(p. 411)*

Composition of Functions

- How do you compute the composition of two functions? *(pp. 417-419)*
- What is the composition of a function with its inverse? *(p. 421)*
- Why is a composition of one-to-one functions one-to-one? *(pp. 421-422)*
- Why is a composition of onto functions onto? *(pp. 423-424)*

Applications of Functions

- What is a Hash function? *(p. 401)*
- How do you show that one set has the same cardinality as another? *(pp. 429-430)*
- How do you show that a given set is countably infinite? countable? *(p. 431)*
- How do you show that the set of all positive rational numbers is countable? *(p. 433)*
- How is the Cantor diagonalization process used to show that the set of real numbers between 0 and 1 is uncountable? *(pp. 433-435)*
- How do you show that the set of all computer programs in a given computer language is countable? *(pp. 437-438)*