Review Guide: Chapter 11

Definitions: How are the following terms defined?

- real-valued function of a real variable *(p. 717)*
- graph of a real-valued function of a real variable *(p. 717)*
- power function with exponent a *(p. 718)*
- floor function *(p. 719)*
- multiple of a real-valued function of a real variable *(p. 721)*
- increasing function *(p. 722)*
- decreasing function *(p. 722)*
- $f(x)$ is $\Omega(g(x)$, where f and g are real-valued functions of a real variable defined on the same set of nonnegative real numbers *(p. 727)*
- $f(x)$ is $O(g(x)$, where f and g are real-valued functions of a real variable defined on the same set of nonnegative real numbers *(p. 727)*
- $f(x)$ is $\Theta(g(x)$, where f and g are real-valued functions of a real variable defined on the same set of nonnegative real numbers *(p. 727)*
- algorithm A is $\Theta(g(n)$ (or A has order $g(n)$) *(p. 741)*
- algorithm A is $\Omega(g(n)$ (or A has a best case order $g(n)$) *(p. 741)*
- algorithm A is $O(g(n)$ (or A has a worst case order $g(n)$) *(p. 741)*
- polynomial time algorithms, NP class, NP-complete problems, the P vs. NP problem, tractable and intractable problems *(pp. 775-776)*

Polynomial and Rational Functions and Their Orders

- What is the graph of the floor function? *(pp. 719-720)*
- What is the difference between the graph of a function defined on an interval of real numbers and the graph of a function defined on a set of integers? *(p. 720)*
- How do you graph a multiple of a real-valued function of a real variable? *(p. 721)*
- How do you prove that a function is increasing (decreasing)? *(p. 723)*
- What are some properties of O-, Ω-, and Θ-notation? Can you prove them? *(p. 728)*
- If $x > 1$, what is the relationship between x^r and x^s, where r and s are rational numbers and $r < s$? *(p. 729)*
- Given a polynomial, how do you use the definition of Θ-notation to show that the polynomial has order x^n, where n is the degree of the polynomial? *(pp. 730-732)*
- What is the theorem on polynomial orders? *(p. 733)*
- What is an order for the sum of the first n integers? *(p. 735)*
- What is an order for a function that is a ratio of rational power functions? *(p. 736)*

Efficiency of Algorithms

- How do you compute the order of an algorithm segment that contains a loop? a nested loop? *(pp. 742-744)*
- How do you find the number of times a loop will iterate when an algorithm segment is executed? *(p. 743)*
- How do you use the theorem on polynomial orders to help find the order of an algorithm segment? *(p. 744)*
- What is the sequential search algorithm? How do you compute its worst case order? its average case order? *(pp. 739-740)*

- What is the insertion sort algorithm? How do you compute its best and worst case orders? *(pp. 740, 744-746)*

Logarithmic and Exponential Orders

- What do the graphs of logarithmic and exponential functions look like? *(pp. 751-752)*
- What can you say about the base 2 logarithm of a number that is between two consecutive powers of 2? *(p. 753)*
- How do you compute the number of bits needed to represent a positive integer in binary notation? *(p. 755)*
- How are logarithms used to solve recurrence relations? *(pp. 755-757)*
- If $b > 1$, what can you say about the relation among $\log_b x$, x^r, and $x \log_b x$? *(p. 758)*
- If $b > 1$ and $c > 1$, how are orders of $\log_b x$ and $\log_c x$ related? *(p. 760)*
- What is an order for a harmonic sum? *(pp. 760-762)*
- What is a divide-and-conquer algorithm? *(p. 765)*
- What is the binary search algorithm? *(pp. 765-767)*
- What is the worst case order for the binary search algorithm, and how do you find it? *(pp. 768-772)*
- What is the merge sort algorithm? *(pp. 772-775)*
- What is the worst case order for the merge sort algorithm, and how do you find it? *(p. 775)*