This homework covers material from Chapter 3.1 through Chapter 4.3 in the textbook.

1. Prove that \(n^{1/2}\) is \(O(n)\). Don’t forget to solve for the correct values of \(k\) and \(C\).

2. Prove that \(\log n\) is \(\Omega(1)\). Don’t forget to solve for the correct values of \(k\) and \(C\).

3. Describe how the number of comparisons used in the worst case for BubbleSort changes when the size of the list to be sorted doubles from \(n\) to \(2n\)

4. Arrange the following functions in a list so that each function is big-\(O\) of the next function \(\sqrt{n}\), \(\log n\), \(n^{1.5}\), \(n \log n\), \(n!\), \(2^n\).

5. Suppose \(f(x)\) is \(O(g(x))\). Is it the case that \(2^{f(x)}\) is \(O(2^{g(x)})\)?

6. Exercise 3.2.70, “Let \(H_n\) be the \(n\)-th Harmonic number...”

7. Exercise 3.3.14, (Horner’s Method problem)

8. Show that the following problem is unsolvable: Determine if a given program run on a given input ever outputs the number “42”.

9. Prove or disprove that for integers if \(a|bc\) then \(a|b\) or \(a|c\) for integers \(a, b, c\). (Be careful)

10. List 5 integers that are congruent to 1 modulo 12.

11. Which of the following integers are congruent to 2 modulo 7? 2, 3, 16, 14, \(-2\), \(-10\)

12. Find \(\gcd(123, 277)\) and \(\gcd(1349, 1786)\) using Euclid’s algorithm. Show your work