

MATH213 HW 3

Due Wednesday, September 13

Solve five of the six problems below.

1. Use the bubble sort and the insertion sort algorithms to sort 5, 3, 9, 7, 1 showing the lists obtained at each step.

2. Use the merge sort to sort alphabetically $q, w, e, r, t, y, u, i, o, p, a, s, d, f$ showing the lists obtained at each step.

3. Perform the first stage of the tournament sort with the sequence in Problem 2. Show the intermediate results. Just the answer does not count.

4. Determine whether each of these functions is $O(x^3)$ and whether it is $o(x^3)$:

(a) $f_1(x) = 1000 + 10x^2 + \frac{x^3}{1+x}$; (b) $f_2(x) = -1000 + x^2 + x\frac{x^3}{1+x}$; (c) $f_3(x) = \frac{2^x}{x^9} - x^3$;
(d) $f_4(x) = 3^{\log_2 x}$.

5. For functions $f(x) = \frac{x^2}{3-x} \log_3 x + \sqrt{x}$ and $g(x) = \frac{x^5+x}{1+x+x^4}$, determine whether $f(x) = O(g(x))$, $f(x) = \Omega(g(x))$, or $f(x) = \Theta(g(x))$.

6. For each of these lists of integers, provide a simple formula or rule that generates the terms of a sequence that begins with the given list:

(a) 1, -1, 2, -2, 3, -3, 4, -4, ... (b) -1, 0, 3, 8, 15, 24, 35, 48, 63, ...
(c) 5, 4, 2, -1, -5, -10, -16, -23, -31, ... (d) 2, 3, 5, 9, 17, 33, 65, 129, 257, 513, 1025, ...
(e) 1, 10, 11, 100, 101, 110, 111, 1000, 1001, 1010, 1011, 1100, 1101, ...