COP 3502 Quiz #3 Version A (Algorithm Analysis, Sorting)

Last Name: _____, First Name: _____

Circle Your Recitation: F12:30 F1:30 F2:30 F3:30 F4:30

1) (5 pts) A sorting algorithm sorts n values in O(nlgn) time. When run on an input of size $n = 2^{20}$, the algorithm takes 800 ms. How long, **in seconds**, is the algorithm expected to take when run on an input of size $n = 2^{25}$?

2) (8 pts) Give a closed form solution for the following summation in terms of n:

$$\sum_{i=n}^{2n}(\sum_{j=n}^{2n} j)$$

3) (10 pts) Use the iteration technique to solve the following recurrence relation:

$$T(n) = 2T(n-1) + 2^n, for\ all\ integers\ n > 0$$
$$T(0) = 1$$

Please provide your answer as an exact function that is a closed form representation of T(n).

4) (5 pts) Show the contents of the following array after each iteration of Bubble Sort:

Initial Values	8	3	6	1	7	5	2
1st iteration							
2nd iteration							
3rd iteration							
4th iteration							
5th iteration							
Last iteration	1	2	3	5	6	7	8

5) (4 pts) Show the result of partitioning the array below, using the leftmost element as the partition element. Please use the in-place partitioning algorithm shown in class.

Initial Values	6	9	3	12	5	2	13	18	4	1	7
After Partition											

6) (3 pts) Why does Quick Sort run faster than Merge Sort, on average, in practice?

Summation Formulas

$\sum_{i=1}^{n} c = cn \sum_{i=1}^{n} i = \frac{n(n+1)}{2}$, $\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$, $\sum_{i=1}^{n} i^3 = \frac{n^2(n+1)^2}{4}$, $\sum_{i=0}^{\infty} x^i = \frac{1}{1-x}, |x| < 1$

$\sum_{i=0}^{n} x^i = \frac{x^{n+1}-1}{x-1}$

Scratch Page - Please clearly label any work on this page you would like graded.