Analysis of Algorithms Assessment Test December 4, 2020

Total 50 points

1. [4 points] True or False:

   _____ When we say that a problem is in the class NP, we mean that it cannot be worked in polynomial time.

   _____ There are cases where bubblesort is the fastest sorting method for that situation.

2. [10 points] Which of the following answers best describes the running time of each of the following code fragments: $O(logn), O(n), O(nlogn), O(n^2)$,

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   ```
   for (i=1,i<n,i++)
    for (j=i, j<i,j++)
     cout << Hello World << endl;
   ```

   ```
   for (i = 1,i<n,i=2*i)
    for (j=1, j<i, j++)
     cout << Hello World << endl;
   ```

3. [10 points] Fill in the blanks:

   _____ and _____ are examples of divide-and-conquer sorting algorithms.

4. [5 points] In the decision tree model of compostion, no algorithm which sorts n items can have fewer than _____ comparisons in the worst case.

5. [5 points] When an item is deleted from a stack, it is always the most recently inserted item. On the other hand, when an item is deleted from a queue, it is always _____ which is deleted

6. [5 points] There are several techniques for balancing binary search trees. If T is a balanced binary search tree, the time it takes to execute a "find" in T is _____ . (Give an asymptotic answer.)

7. [6 points] Suppose F(n) = 2F(n/2) + 5n. Then F(n) = _____ (Give an asymptotic answer.)

8. [5 points] There is a programming technique called _____ which consists of solving subproblems of increasing complexity, where each subproblem can be solved using the solutions to previously solved subproblems.