15-451/651 Algorithms, Fall 2013 Course Survey

Name: _____ **Section:** _____

Major: _____ 451 or 651? _____

This survey is worth 5 bonus points on hwk 1. It not a "test", meaning that you will get those points whether your answers to the mathematical questions below are correct or not. The purpose of this survey is to get a sense of what topics you are comfortable with (and hence we can cover faster) and what topics you would like more help with. *However, if you get all the mathematical questions correct, you will be entered into a drawing for a free pizza.*

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1. When did you take the 15-251 course?

   Never Spring '13 Fall '12 Spring '12 Fall '11

   Other (specify) _____

2. When did you take the 15-210 course?

   Never Spring '13 Fall '12 Spring '12 Fall '11

   Other (specify) _____

3. These are some topics that you have probably seen in previous courses (15-210, 15-251, or other courses). On a scale of 1 to 5, score how well you remember/understand the topics. (0 = "never seen before", 1 = "can barely remember", 5 = "very comfortable"):

   - solving recurrences
   - probability
   - minimum spanning trees
   - depth first search
   - shortest paths (and Dijkstra's algorithm)
   - quicksort
   - dynamic programming

4. The recurrence $T(n) = 3T(n/3) + n$ with $T(1) = 1$ solves to what?

   a. $T(n) = \Theta(n \log n)$
   b. $T(n) = \Theta(n)$
   c. $T(n) = \Theta(n^{\log_3 4})$
   d. None of the above
   e. I don't know what the question means.

5. If $f(n) = O(g(n))$ and $g(n) = O(h(n))$ then which of the following are true (check all that apply):

   a. $g(n) = \Omega(f(n))$
   b. $f(n) = \Omega(h(n))$
   c. $f(n) = O(h(n))$
   d. $f(n) \leq g(n)$ for all naturals $n \geq 1$
   e. $f(n) + g(n) = O(h(n))$
   f. I don't know what these things mean

6. What is the expected total number of comparisons performed by `QuickSort` when given n numbers to sort:

   a. $\Theta(n^2)$
   b. $\Theta(n \log^2 n)$
   c. $\Theta(n \log n)$
   d. $\Theta(n)$
   e. none of the above
   f. I don't know what these things mean

7. A deck of 52 cards is taken out and shuffled until completely random. In expectation, how many cards end up in the same position as they started?

   a. slightly less than .02
   b. 1
   c. 26
   d. some complicated formula I can't calculate without a calculator
   e. I have no idea

8. Give a closed-form expression for the infinite sum

$$1 + \frac{9}{10} + \left(\frac{9}{10}\right)^2 + \left(\frac{9}{10}\right)^3 + \left(\frac{9}{10}\right)^4 + \cdots$$

   For partial credit, give the best upper and lower bounds you can give on the sum.