Abstract

Here are some of the findings after marking the background quiz. (I wish they weren't true!) I will like to get some (sincere) feedback from the students in terms of what is going wrong? In a nutshell nobody got perfect - everybody got at least one correct answer - average will be less that 50% (I do not even want to compute this!) - many fundamental concepts went up the roof - e.g. sorting was faster than searching for a few - the cardinality of powerset was anybody's guess- number of edges in the graph was anybodys guess - for some of you sum of the first n natural numbers was $n!$ - for many construction time of Binary Search Trees was 2^n (or even $\log n$) - halting problem was a piece of cake for many. Very few had some idea of what is $T(n)$? How to analyze simple recurrences? It seemed that the recurrences for sorting and searching (the two most fundamental problems in CS) were completely new to many of you. I have just made comments on the few - the results on other problems are not vastly different.

In my opinion, **about 30% of the students** (class size is around 70; but 52 wrote the quiz) who appeared in the quiz had some decent background preparation.

My simple advise:: Please do this quiz again yourself - find out what went wrong - how you can correct it - and if I can be of any help - please do not hesitate to come and talk to me. **Please please please review the first three chapters and Appendix A and B of the text book NOW** - do the problems in these chapters before the first Assignment hits you (which is in less than two weeks).

Background Quiz COMP 3804

January 2010, 20 mins

Question 1: What is the time complexity of sorting n real numbers?

Answers included: $O(n)$; $O(n \log n)$; $O(\log n)$; $O(n^2)$; $O(1)$; ; $\log n - 1$; $O(n!)$.
17 out of 52 had the correct answer.

Question 2: What is the time complexity of searching an element in a sorted array consisting of n real numbers?

Answers included $O(n)$; $O(\log n)$; $\leq n$; ; $O(1)$;

Question 3: What is the maximum number of subsets you can form from a set consisting of n-elements?

Answers included : $n!$; n^n; $n + 1$; 2^n; ; n subsets of 1; $n^n + 1$; $n - 1$; $n!$+1; a lot; many; $(n + 1)!$; 2^{2^n}; $2^n - 1$; n^2; $n + 2$; $n^2 - n$; $3n + 1$; $O(n^2)$.
13 out 52 got the right answer.

Question 4: What is $\log_2 128$?

Answers included: $\frac{\log_{10} 128}{\log_{10} 10}$; 2^7, 7, 8; 2^{128}, 6, 64, $\sqrt{128}$;
Score 32/52.

Question 5: What is the time complexity of constructing a binary search tree on n-nodes?

Answers included: $O(n^2)$; $O(n)$; $O(2^n)$; $O()$; $O(\log n)$; $O(\log n)$; $O(n/2)$; e^n; $O(2n)$; $O(n!)$ $O(\log 2^n)$; ;
Score: 9/52

Question 6: Is it possible to write a program that takes two inputs
(a) A program P written in Java
(b) An input p to P
and produces as output whether P will terminate on input p or it will not terminate?

Score: 24/52

Question 7: What is the sum of the series $1 + 2 + 3 + \cdots + n$?

Answers included: $n(n+1)^2/(n-1)$; Divergent geometric series; $n(n-1)$; 10 or 15; $n(n+2)$; $n!$; $n(n+1)/2$; $\frac{n+1}{2}$; $2(n+1) - n$; $n(n-1)/n^2$;
Score : 20/52

Question 8: What does the recurrence $T(n) = 2T(n/2) + n$, where $T(1) = 1$, evaluates to?

Answers included $O(n \log n)$; $2 \log n$; $O(n)$; $O(3n)$; Binary Tree; $O(\log n)$; $O(n^2)$; 1; $1 + 1/2^{\log n}$; $n + 2O(n)$; $O(n^2 + n)$; $2n$; $T(n+1)$; $n^2 + n$; $2T(1/2) + 1$; 0;
Score : 6/52

Question 9: What does the recurrence $T(n) = T(n/2) + 1$, where $T(1) = 1$, evaluates to?

Question 10: (Rephrased) Is it true that a graph on n vertices consisting of at least n edges can be a tree?

Question 11: What is the maximum number of edges that a graph on n vertices can have?

Answers included: $n - 1$; $n(n-1)$; n^2; n; $n + 2$; $n(n-1)/2$; $2n$; $n^2 - 1$; $2^n - 1$; $2(n-1)$.
Score: 10/52

Question 12: What is the sum of the series $\sum_{i=1}^{n} k$?

Question 13: We have two algorithms for a problem. Algorithm A runs in $O(n^3)$ time and Algorithm B runs in $O(1.5^n)$ time. Which algorithm will you use for sufficiently large values of n?

Question 14: Is $\log_2 \frac{a}{b} = \log_2 a - \log_2 b$?

Question 15: Is $\log_2 1000 = \frac{\log_{10} 1000}{\log_2 10}$?

Question 16: Is the set of languages that are recognized by a non-deterministic finite automata is identical to the set of languages recognized by a deterministic finite automata?

Question 17: How many comparisons are sufficient to merge two sorted lists A and B, each consisting of n-real numbers, in a single sorted list?
