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 anybody’s 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: $\log_{10} \frac{128}{10}$; $2^7$, 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?
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 + $1/2 \log n$; $n + 2O(n)$; $O(n^2 + n)$; 2$n$; $T(n + 1)$; $n^2 + n$; $2T(1/2) + 1$; 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: $n - 1$; $n(n - 1)$; $n^2$; $n$; $n + 2$; $n(n - 1)/2$; 2$n$; $n^2 - 1$; $2^n - 1$; 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?