Computer Science 477/677 Spring 1999 Final Exam 6:00 PM, Monday, May 10, 1999, TBE B174

Name:_	
this pag	ks, notes, or scratch paper. Use pen or pencil, any color. Use the rest of ge and the backs of the pages for scratch paper. If you need more scratch it will be provided.
The end	tire test is 270 points.
1. True	e or false. [5 points each.]
(a)	Computers are so fast nowadays that discussion of time complexity is obsolete.
(b)	One of the operators of a Heap is find.
2. Fill	in the blanks. [5 points each blank.]
(a)	is known to be an \mathcal{NP} -complete problem.
(b)	programming is a technique whereby a family of subproblems is solved in an appropriate order, such that the solution of each subproblem may depend on the solutions of prior subproblems.
(c)	A of a graph G is a maximal non-empty connected subgraph of G .
(d)	[three words] and [three words] are two standard technique of visiting the nodes of a directed graph.
(e)	order is any order of an acyclic directed graph such that if e is an edge from node x to node y , then node x comes before y in the order.
(f)	is an order of the nodes of an ordered tree such that, if node x is the parent of nodes y and z , and if y is to the left of z , then y comes before z and z comes before x in the ordering.
(g)	A binary tree of height h must have at most nodes. [Exact formula, please.]

3. Solve each of the following recurrences [10 points each], giving each answer in Θ notation.

(a)
$$f(n) = 2f(\frac{n}{2}) + 3n$$

(b)
$$g(n) = g(\sqrt{n}) + 1$$

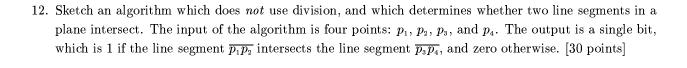
(c)
$$T(n) = 2T(n-1) + 1$$

(d)
$$h(n) = n + h(\frac{1}{3}n) + h(\frac{3}{5}n)$$

4.	What is a spanning tree of a graph? [10 points]
5.	Give the three standard operators for the ADT $stack$, other than a constructor operator. Just the names of the operators, please. [10 points]
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ο.	Give the two standard operators for the ADT $array$, other than a constructor operator. Just the names of the operators, please. [10 points]
7.	Give the three standard operators for the ADT $search\ structure$, other than a constructor operator. Just
•	the names of the operators, please. [10 points]
8.	Give four different implementations of the ADT $search\ structure$, all very different from one another.
	(Do not describe them in detail, unless they are not ones that we discussed in class. This should not be necessary, since we discussed at least four in class.) [20 points]

9.	Sketch a sorting algorithm which sorts an array A of length n in $O(n^2)$ time but uses only constant space other than the space used to store A itself. [15 points]
10	Clastel Manager [15 maintel]
10.	Sketch Mergesort. [15 points]

11. Sketch Quicksort. [30 points]



13.	Sketch Dijkstra's algorithm for solving the single source shortest path problem for a weighted directed graph with no negative weights. $[30 \text{ points}]$