

CS 4/56101

Example Final

Spring 2002

NAME (please print legibly): _____

Your University ID Number: _____

- This is an open book-open notes exam
- Please show all your work. You may use back pages if necessary. You may not receive full credit for a correct answer if there is no work shown.
- The question presented in the example final are intended only as representatives the types of questions that will appear - the point values indicated are not necessarily indicative of the point structure that will be used for the actual final exam.

QUESTION	VALUE	SCORE
1	20	
2	10	
3	10	
4	20	
5	15	
6	25	
TOTAL	100	

1. (20 pts) for each problem below, circle *all* of the choices that correctly answer the question or complete the statement. Cross out the remaining (incorrect) choices, and in the space provided, briefly explain why the item is wrong. (You need not explain correct answers.) If you circle or cross out incorrectly, you will be penalized, so leave the choice blank unless you are reasonable sure.

(a) which of the following algorithms are greedy?

1. Prim's algorithm for finding a minimum spanning tree
2. the activity selection algorithm
3. the longest common subsequence algorithm
4. Dijkstra's algorithm for solving the single-source shortest paths problem

(b) Which of the following can be performed in worst-case linear time with regard to input size

1. Building a binary heap from an unordered list of numbers
2. walking a red-black tree inorder
3. solving the single-source shortest paths problem on an acyclic directed graph
4. solving the string-matching problem

2. (10 pts) State the general greedy method for finding minimum spanning trees. Show that Kruskal's algorithm is a special case of the general greedy method.

3. (10 pts) Consider a red-black tree on n keys that maintains, in each node of the tree, the height of the node. Describe how to update this height information efficiently when a rotation occurs. Analyze the running time of your update algorithm

4. (20 pts) Circle T or F for each of the following statements to indicate whether the statement is true or false, respectively. If the statement is correct, briefly state why. If the statement is wrong, correct it. The more content you provide in your justification or correction, the higher your grade, but be brief. One-sentence explanations should suffice.

T F The worst-case running time of randomized quicksort on an array of length n is $\omega(n^2)$

T F A binary search tree on n integer keys in the range from 1 to n^2 can be constructed in $O(n)$ worst case time.

5. (15 pts) Show that the longest simple path from a node x in a red-black tree to a descendant leaf has length at most twice that of the shortest simple path from node x to a descendant leaf.

6. (25 pts) A graph G contains V vertices and E edges. You want to order the vertices in non-decreasing order based on the number of edges adjacent to each vertex.

(a) Write a procedure to solve this problem (you are free to use procedures from the book as pre-processing steps/subroutines in your solution).

(b) Analyze the running time of your solution

(c) State if the running time of your algorithm changes with relation to the ratio of vertices to edges.