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Illinois Institute of Technology Computer Science

Second Exam

CS 331 — Data Structures
Fall, 2010
Friday, October 29, 2010 15:15–16:30

This is a **closed book** and **closed notes** exam.
You are **not** allowed to use calculators or computers during this exam.
Do **ALL** problems in this booklet. Read each question very carefully.
You may detach pages, but **you must return all pages of this exam.**

Name	
Email ID	@iit.edu

Problem	Points	Score
1	4	
2	4	
3	4	
4	4	
5	4	
6	4	
7	4	
8	4	
9	4	
10	6	
11	8	
12	6	
13	6	
14	6	
Total	68	
Percent	100	

1 Locality

Question 1) (4 points) What is temporal locality?

Question 2) (4 points) What is spatial locality?

Question 3) (4 points) Under what circumstances would you use the *swap* heuristic?

Question 4) (4 points)
Consider this list.

Suppose we now find the 8 node. Show the effect of using the *swap* heuristic.

Question 5) (4 points)
Consider this list.

Suppose we now find the 8 node. Show the effect of using the *move-to-front* heuristic.

2 Sorting

Question 6) (4 points)

Two sorting algorithms we studied are able to provide useful data even if they are interrupted. Which are they?

Question 7) (4 points)

Two sorting algorithms we studied work especially well if the data they are given happen to be already sorted, or nearly so. Which are they?

Question 8) (6 points)

One sorting algorithm suffers an extreme loss of performance if the data it is given happen to be already sorted. Which algorithm is this, and how can the algorithm be fixed to prevent this?

Question 9) (6 points) Consider the following array:

6	1	9	11	7	3	4

What will be the first three elements selected if we run selection sort on this array?

What will be the first three elements inserted if we run insertion sort on this array?

Question 10) (6 points) Consider the following array:

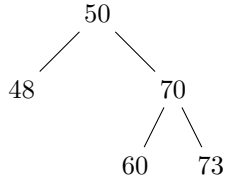
26	32	29	41	17	33	24

Show the effect of running quicksort's partition algorithm on the above array. Use the first element as the pivot.

3 Binary Search Trees

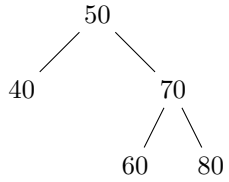
Question 11) (4 points)

Show the effect of adding a 35 and a 72 to the following tree. You may modify the figure or redraw it.



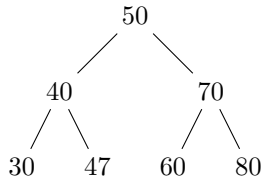
Question 12) (4 points)

Show the effect of deleting element 40 from the following tree. You may modify the figure or redraw it.



Question 13) (4 points)

Show the effect of deleting element 50 from following tree. You may modify the figure or redraw it.

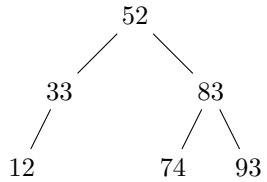


Question 14) (4 points)
What is the expected time complexity for an add operation on a BST?

Question 15) (4 points) What is the worst case time complexity for add? Under what circumstances does it occur?

4 Tree Traversals

Question 16) (8 points)



Write down the following traversals for the above tree:

Preorder

Postorder

Inorder

Level-order

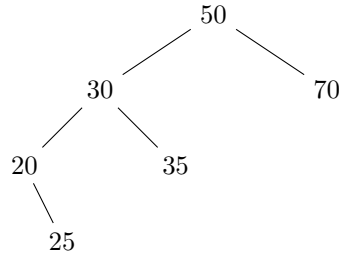
Question 17) (4 points)

Compare depth first search and breadth first search, giving one advantage each has over the other.

5 AVL Trees

Question 18) (6 points)

Consider the following AVL tree.



A node has just been added to the tree, and now it is out of balance.

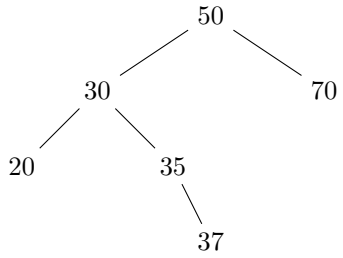
1. Which node is out of balance?

2. What kind of rotation is needed to restore balance?

3. Show the effect of the rotation.

Question 19) (6 points)

Consider the following AVL tree.



A node has just been added to the tree, and now it is out of balance.

1. Which node is out of balance?

2. What kind of rotation is needed to restore balance?

3. Show the effect of the rotation.