Spring 2009 CS 225 Exam 4 - Take home exam

Read each question carefully.

As a take home exam, it is expected that: the answers listed are entirely your own work, your answers are clear & your writing is legible.

1. A single B-tree node can potential hold very many elements. Explain why this does not negatively impact the time required to search the tree for an element. 5 pts

2. Explain why the ideal pivot element for quicksort is the median. 5pts.

3. Explain why starting with a sorted list results in poor performance with quicksort. 5pts.

4. In big O notation indicate the performance of the following operations on the indicated data structures: 1 pt each

A. **InsertionSort**

B. **MergeSort**

C. **HeapSort**

D. **QuickSort**

5. List the six general rules for B-trees. 3 pts

6. Starting with sequence shown below, use the format provided during lecture to provide a high level illustration of the merge sort algorithm. 4pts

43,11,90,67,77,18,51,20,80,28

7. Using the format provided during lecture to illustrate the details of the last merging step of a merge sort performed in question 6. 2 pts

8. Starting with array shown below, use the format provided during lecture to illustrate the quicksort algorithm. 4 pts

41,12,89,63,23,47,78,32

Note: there are no questions numbered 9 through 11. This was a typo, but rather than renumber the questions & cause more confusion, I'm leaving them as originally numbered.

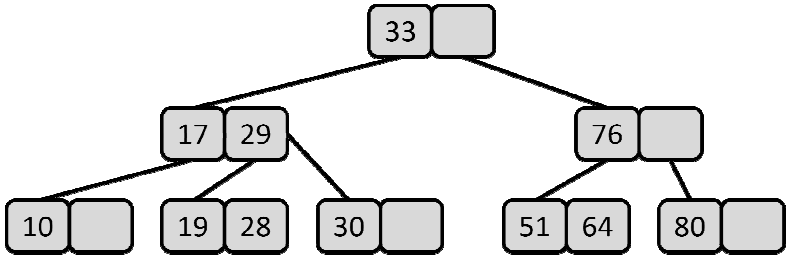
12. Starting with the array shown below, use the format provided during lecture (and in the text book) to illustrate the insertion sort algorithm. 3pts

43,11,90,67,77,18,51,20,80,28

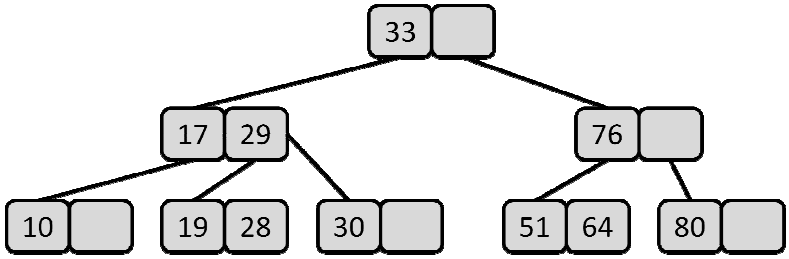
13. Starting with the array shown below, use the format provided during lecture (and in the text book) to illustrate the selection sort algorithm. 3pts

43,11,90,67,77,18,51,20,80,28

14. Starting with the B-Tree below, illustrate how to add the element 18 into the tree. 4pts.



15. Starting with the B-Tree below, illustrate how to remove the element 17 from the tree. 4pts.



Multiple choice 1 pt each

16. Which statement is true for a B-tree?

A. All entries of a node are greater than or equal to the entries in the node's children.
B. All leaves are at the exact same depth.
C. All nodes contain the exact same number of entries.
D. All non-leaf nodes have the exact same number of children.
E. Exactly two of the above answers are correct.
F. None of the above.

17. Suppose that a non-leaf node in a B-tree has 41 entries. How many children will this node have?

A. 2
B. 40
C. 41
D. 42
E. 82
F. Anything ≥ MININUM & ≤ MAXIMUM is correct.

18. Suppose that a B-tree has MAXIMUM of 10 and that a node already contains the integers 1 through 10. If a new value, 11, is added to this node, the node will split into two pieces. What values will be in these two pieces?

A. The first piece will have only 1 and the second piece will have the rest of the numbers.
B. The first piece will have 1 through 5 and the second piece will have 6 through 11.
C. The first piece will have 1 through 5 and the second piece will have 7 through 11.
D. The first piece will have 1 through 6 and the second piece will have 7 through 11.
E. The first piece will have 1 through 10 and the second piece will have only 11.
F. None of the above.

19. Suppose that X is a B-tree leaf containing 41 entries and having at least one sibling. Which statement is true?

A. Any sibling of X is also a leaf.
B. Any sibling of X contains at least 41 entries.
C. The parent of X has exactly 42 entries.
D. X has at least 41 siblings.
E. Exactly two of the above answers are correct.
F. None of the above.