Name_____ ID #_____ Seat No. _____

King Mongkut's University of Technology Thonburi
Final Examination of Second Semester, Academic Year 2007

COURSE CPE 130 Algorithms and Data Structures **Computer Engineering Department, 1st Yr.**
Wednesday, March 5, 2008 **9.00-12.00 h.**

Instructions

1. This examination contains 13 questions, 10 pages (including this cover page).
2. The answers must be written in the examination paper. You may use the back of the paper.
3. Students are allowed to use a calculator.
4. Students are allowed to bring a dictionary that conforms to the university's regulations.
5. No books, notes, or any other documents can be taken into the examination room.

Students must raise their hand to inform to the proctor upon their completion of the examination, to ask for permission to leave the examination room.
Students must not take the examination and the answers out of the examination room.

Students will be punished if they violate any examination rules. The highest punishment is dismissal.

This examination is created by

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This examination is approved by the Computer Engineering Department

(Assoc. Prof. Suthep Madarasmi, Ph.D.)
Chair

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Total points = 50 points

1. Show the sorting process of the following elements using **Merge** method (5 points)

37	9	23	56	4	5	12	45	78	22	33	44	14	17	57	11	25	46

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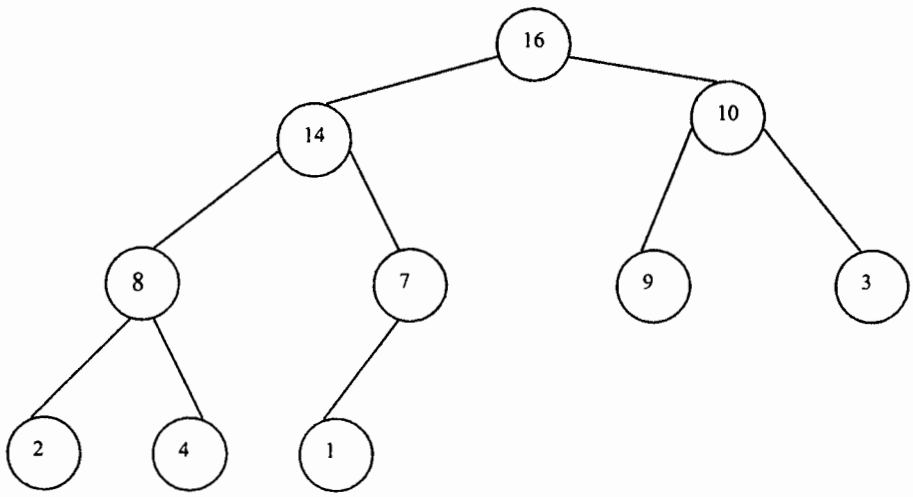
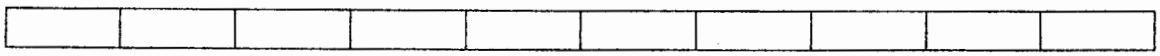
2. Heap (5 points)

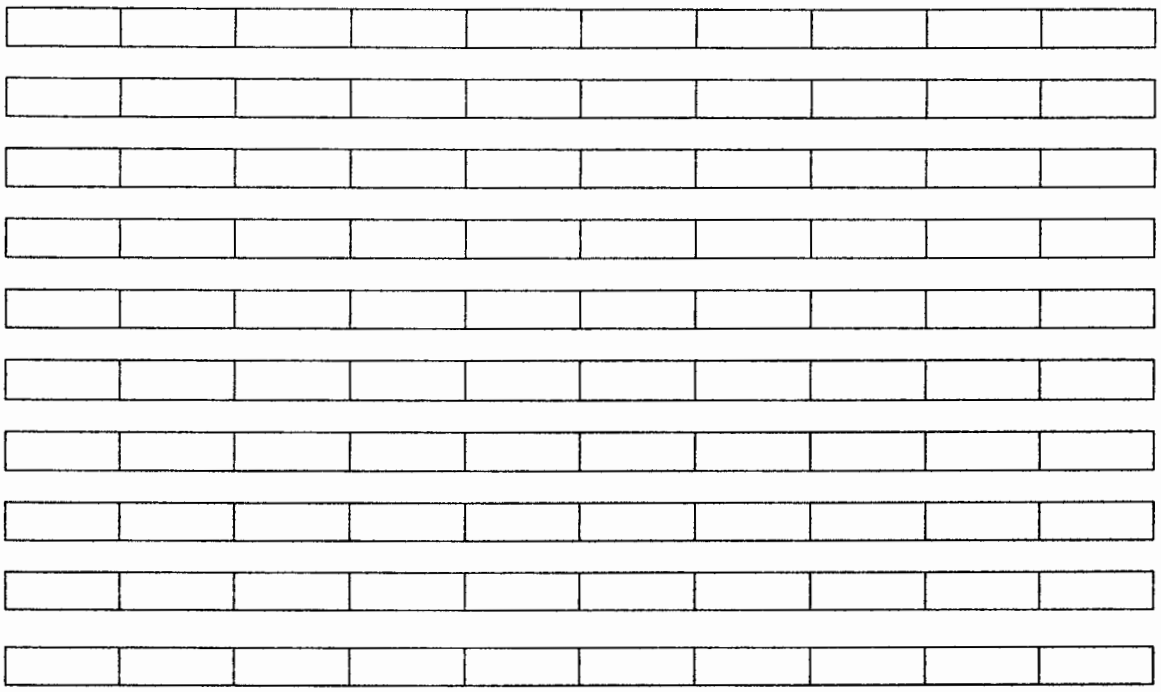
Given the following heap



2.1 Draw the array implementation of the above heap



2.2 From the array of heap in 2.1, fill in the following arrays to show the heap sorting process until the sorting stops.



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3. Binary Search (5 points)

Write an algorithm for binary search on a sorted array in pseudocode or C.

4. A binary tree has 10 nodes. With the following preorder and inorder traversals of the tree, what does the tree look like? (Draw the tree.) (4 points)

Preorder: J C B A D E F I G H
Inorder: A B C E D F J G I H

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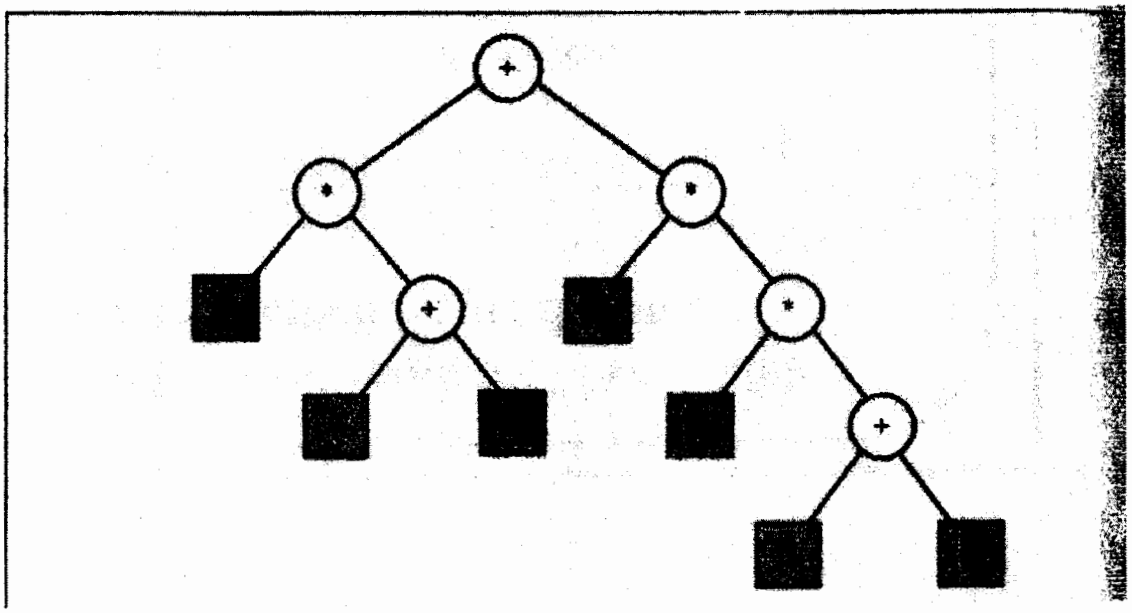
5. Find the prefix and postfix expressions of the following expression tree. (4 points)



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6. Hashing (5 points)

Suppose you have a hash table of the size 17. Use the hash function *h(k) = k mod 17* to store the following integer key values with *quadratic probing*. Insert in the hash table the following integer key values in the given order.

2, 32, 43, 16, 77, 51, 1, 17, 42, 111

Hash Table	
0--	
1--	
2--	
3--	
4--	
5--	
6--	
7--	
8--	
9--	
10--	
11--	
12--	
13--	
14--	
15--	
16--	

How many collision(s) occur(s)? _____

Which value(s) cause(s) the collision(s)? _____

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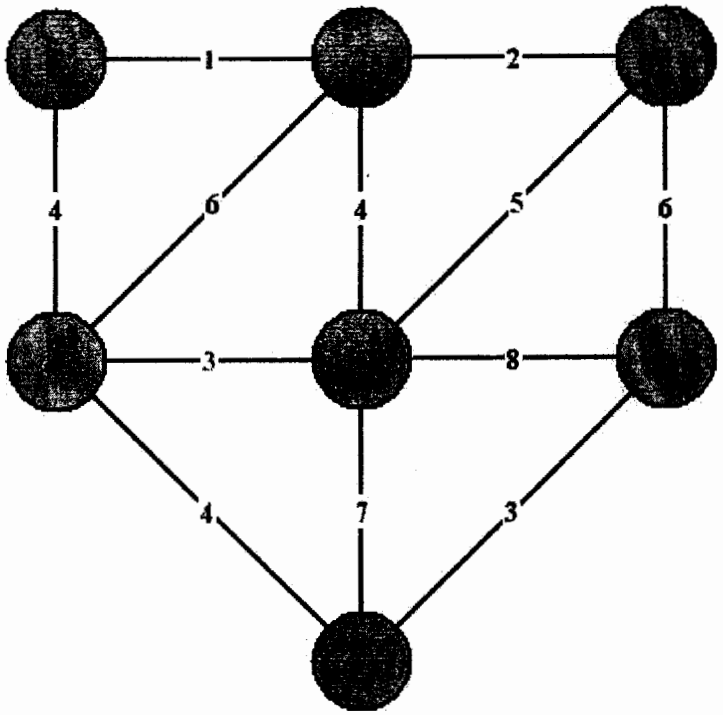
7. Minimum Spanning Tree (5 points)

Draw the minimum spanning tree of the following graph:



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8. Graph (5 points)

Given the following graph represented by the following adjacency matrix:

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	-	17	-	23	5	-	-	
2	17	-	-	15	-	-	-	11
3	-	-	-	21	9	16	-	-
4	23	15	21	-	-	-	20	-
5	5	-	9	-	-	12	-	-
6	-	-	16	-	12		8	-
7	-	-	-	20	-	8	-	10
8	-	11	-	-	-	-	10	-

Draw the graph that the adjacency matrix represents.

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9. Huffman Encoding (8 points)

Given letters A,B,C,D,E,F,G with respective frequencies: 0.1 (A), 0.22 (B), 0.23 (C), 0.11 (D), 0.02 (E), 0.03 (F), 0.29 (G). Build the Huffman code for these letters by drawing the Huffman tree.

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Multiple Choices Choose the best answer from each of the following questions. There is no penalty for guessing. (1 point for each question).

10. Suppose that we have a set of records with one field giving the ID numbers of students, and another field giving the number of a course they are taking. (Thus each record specifies on student in one class.) We wish to sort these records so that all records for a given student are consecutive, and the records for a given student are in order by course number. Which of the strategies below will do the job?

A. Sort the file by student ID using a stable sorting algorithm, and then sort the file by course number using a sorting algorithm which isn't necessarily stable.
B. Sort the file by student ID using a sorting algorithm which isn't necessarily stable, and then sort the file by course number using a stable sorting algorithm.
C. Sort the file by course number using a stable sorting algorithm, and then the file by student ID using a sorting algorithm which isn't necessarily stable.
D. Sort the file by course number using a sorting algorithm which isn't necessarily stable, and then sort the file by student ID using a stable sorting algorithm.

11. Suppose someone needs to sort some files. Which of the following sorting algorithms is *least* likely to be a good choice?

A. Insertion Sort
B. Bubble Sort
C. Quicksort
D. Merge

12. Suppose that the first node in the preorder traversal of some binary tree T is the same as the first node in the postorder traversal of T. Let r be the root of the tree. What can we conclude?

A. r may have left and right children, but the number of nodes in the left subtree of r is equal to the number of nodes in the right subtree of r.
B. r is the only node in the tree.
C. r has no left child, but it may have a right child.
D. r may have a left child, but it has no right child.

13. Suppose that we are representing a heap in an array A indexed from 1 to n, so the root data is in $A[1]$. Where would the left child of the right child of the root be?

A. $A[4]$
B. $A[5]$
C. $A[6]$
D. $A[7]$