M.C.A. FIRST YEAR SECOND SEMESTER EXAMINATION-2018

DATA AND FILE STRUCTURE

Time: Three hours **Full Marks: 100**

Question number 1 is compulsory and answer any four questions from the rest.

1.a) Write a node structure for a B tree of order 5.

b) Compare and contrast a B-tree and a B^+ tree.

c) What is the tradeoff to have a dense or a sparse index?

d) Why does the outermost track in a disk contain an equal amount of data that the innermost track stores although the length of the second is much less than the first?

e) What is a double rotation in an AVL tree? Give an example.

f) What is the difference between external and internal soring techniques?

g) When swapping of elements involve a huge amount of time, which sorting algorithm is the best to apply? Give reason.

h) Write one specific application with justification where the double linked list will be an obvious choice over the single linked list.

i) A queue that is housed in an array usually represented in circular rather than linear fashion but why the same is not done for a linked representation?

j) What data structure would you most likely see in a non-recursive implementation of a recursive algorithm? Justify.

2 × 10

2. a) What is a directory lookup technique for file organization? Explain with an example.
   b) Explain how different probe sequences help to resolve collisions in hashing.
   c) The following values are to be stored in a hash table 25, 42, 96, 101, 102, 162, 168, 197. Describe how the values are hashed by using division method of hashing with a table size of 7. Use separate chaining technique for collision resolution.

4 + 8 + 8

3. a) Write a program to create a binary tree and devise the sequence of input for the tree to be stored whose inorder and preorder traversal sequences are given as follows:

   Inorder : 10, 15, 17, 18, 20, 25, 30, 35, 38, 40, 50

   Preorder: 20, 15, 10, 18, 17, 30, 25, 40, 35, 38, 50

b) Create an AVL tree for the following sequence of keys: 2, 4, 9, 8, 7, 6, 3, 1, 5, 10

12 + 8

4. a) Implement a stack using an array with a provision to return the status of successful or unsuccessful execution of both the PUSH and POP operations.

b) Write an algorithm to convert an expression represented in infix notation into its equivalent postfix expressions.

c) Write a function to reverse the order of elements on a queue using the stack(s).

6 + 8 + 6

5. a) Discuss the properties "Stable" and "In place" for the following sorting algorithms

   (i) Insertion sort (ii) Selection sort (iii) Counting Sort (iv) Quicksort (v) Radix sort

   b) Write an algorithm for quicksort and find its best case and worst case time complexities.

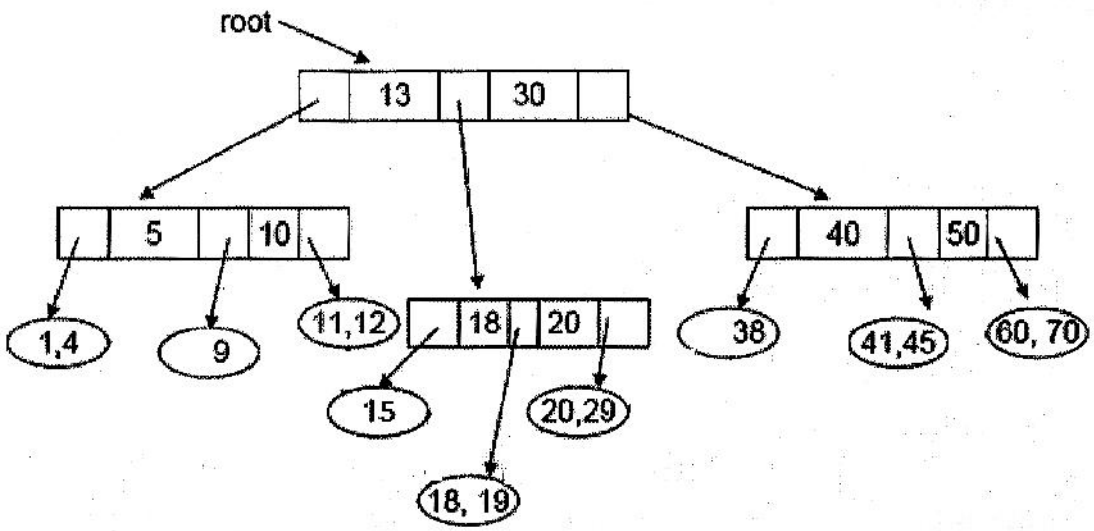
10 + 10

6. a) What is the maximum total number of nodes in a tree that has N levels, with the root at level zero?

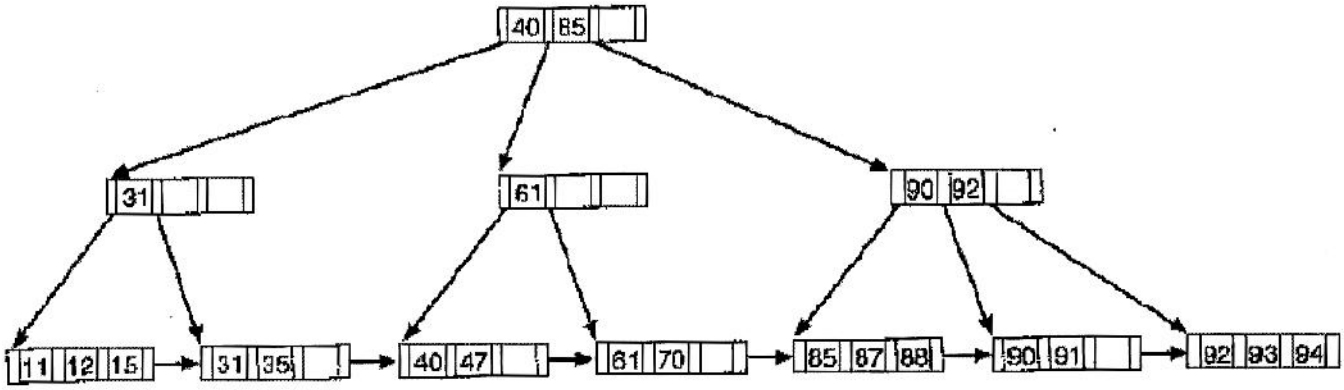
b) Prove that "A tree having 'm' nodes has exactly (m–1) edges or branches".
c) Taking a suitable example explain how a general tree can be represented as a Binary Tree.
d) Write a program to find the smallest number in a binary tree.

4 + 5 + 3 + 8

7.a) Consider the following B -tree. Delete key elements 5 and 10 from it and redraw the tree after the deletions. (Show all the necessary splitting and merging of nodes as per deletion algorithm).



b) Consider the following B^+ -tree. Insert 16 and 20 into it and redraw the tree after the insertions. (Show all the necessary splitting and merging of nodes as per algorithm)



10 + 10

8. a) Consider a magnetic tape with 0.6-inch interblock gaps. Assume that the medium is 2400 feet in length and that data are recorded at a density of 6250 bpi. Contrast the following for the case of one 100-character record per block with the case of twenty 100-character records per block:

(i) The wastage of tape in percentage
(ii) The time required to access the same collection of records

b) Explain the responsibilities of a file system.
c) Compare the record read/write time for movable head disk and fixed head disk.

(5 + 5) + 5 + 5