Total Pages—7

B. Tech/B. Arch
PCS 1001

Second Semester Examination, 2004

Data Structure Using C

Full Marks : 70

Time : 3 hours

Answer any **six** questions, **including** Q. No. 1 which is compulsory

The figures in the right-hand margin indicate marks

1. Answer the following in brief : 2×10

   (a) Given
   $T1(n) = O(f(n))$ $T2(n) = O(f(n))$, find $O(T1(n) + T2(n))$

   (b) $f(N) = N \log N$, $g(N) = N^{1.5}$, which grows faster ? Justify.

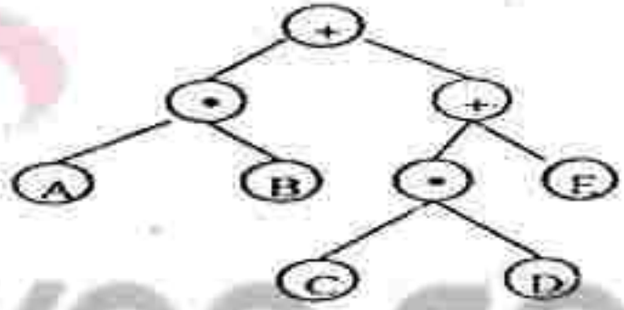
   (c) Convert $a + b^* c + (d^* e + f)^* g$ to prefix expression.

   (d) Transform the postfix expression
   ABCDE - + $* E* EF* - to infix.

(Turn Over)

(e) Write a C routine using iteration to multiply two integers.

(f) Determine the pre-order and post-order traversal



(g) Show that the function f(n) defined by

$$f(n) = \begin{cases} 1, & n = 1 \\ f(n-1) + 1/n, & n > 1 \end{cases}$$

is O(log n)

(h) A full node is a node with two children. Prove that the number of full nodes plus one is equal to the number of leaves in a non-empty tree.

(i) Draw a binary search tree for the sequence 3 1 4 6 9 2 5 7

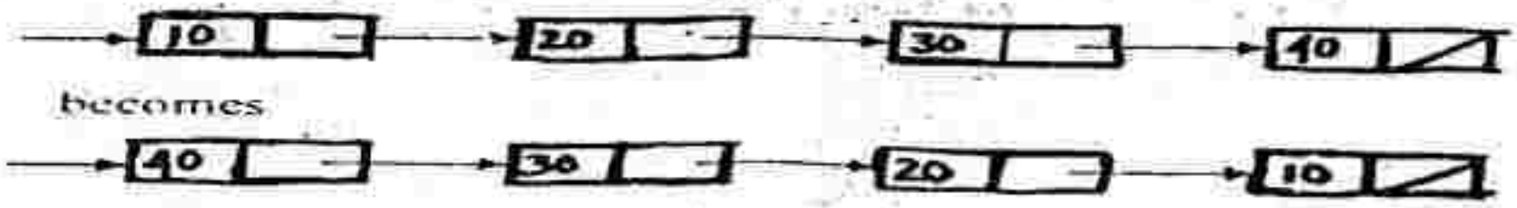
(*j*) Given X = {4371, 1323, 6173, 4199, 4344, 9679, 1989} and h(X) = X (mod 10). Show the resulting hash table using

(*i*) separate chaining

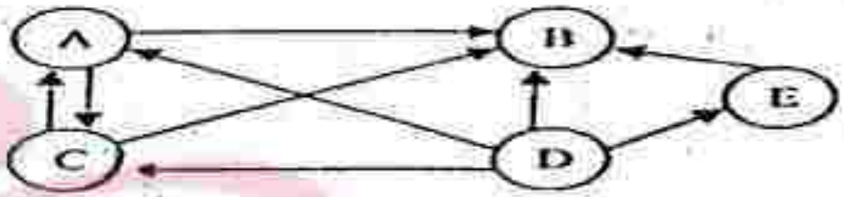
(*ii*) open addressing with linear probing.

2. (*a*) Define a queue. How does it differ from a stack ? Describe the insert and delete operation on a queue. Write two applications of a queue. 1 + 1 + 2 + 1

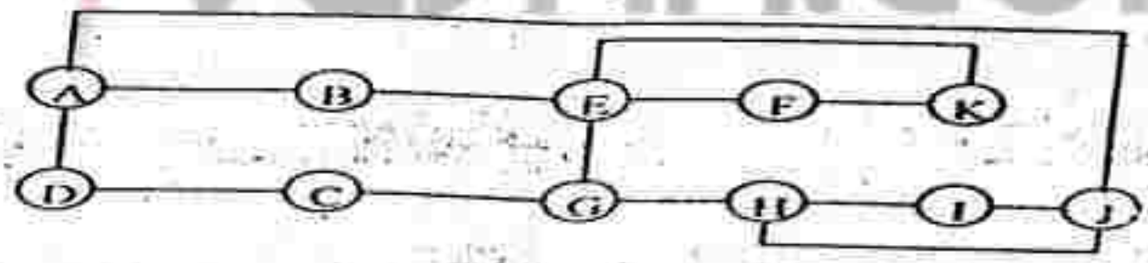
(*b*) Write a program in .c to reverse a integer singly linked list. For example 5



3. (*a*) Describe two methods to represent a graph in the computer. Use the representations to represent the following graph : 2 + 3



(*b*) Describe DFS algorithm. Find out the output the above algorithm if applied to the following graph starting at node A. 2 + 3



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4. (*a*) Write an algorithm to evaluate a postfix expression consisting of binary operators and single digit integer operands. 5

(*b*) L1 and L2 are two linked lists in memory. Write a program to join them to create a single linked list L (L1 followed by L2). Also count the number of nodes in the resultant list. 2 + 3

5. (*a*) What is threaded binary tree? How it is helpful? 4

(*b*) Sketch the binary search tree resulting from the insertion of the following integer keys:
50 72 96 94 107 26 12 11 9 2 10 25 51 21 2 + 2 + 2

(*i*) Traverse the tree in post-order and preorder

(*ii*) Convert the tree to a in-order threaded binary tree.

6. (*a*) Describe the process of heap sort. Show the steps followed to create a heap for the following data:
42 23 74 11 65 58 94 36 99 87 2 + 3

(*b*) Briefly explain the radix sort procedure and hence sort the given data:
42 23 74 11 65 57 94 36 99 87 70 81 61 2 + 3

7. (*a*) Write a C program to count the number of nodes and sum of each nodes in a integer circular linked list. 5

(*b*) Write a C program that merges two ascending order arrays of size m and n respectively to form a new array sorted in ascending order. 5

8. (*a*) What is hashing? What should be the characteristics of a hash function? 2 + 2

(*b*) Hash table of size 10 with two slots contains entries from 0-9. Following keys are mapped into the hash table from a master file:

10, 100, 32, 45, 5, 135, 29, 210, 402, 93, 92, 22, 42

Construct open addressing hash table using

(*i*) linear probing with f(x) = x (mod 10)

(*ii*) quadratic probing with f(x) = x (mod 10)

Find number of collisions in each case. 3 + 3
