Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/MCA/SEM-2/MCA-203/2013

2013

DATA STRUCTURE WITH C

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

i) The following sequence of operations is performed on a stack :

push(1), push(2), pop, push(1), push(2), pop, pop, pop, push(2), pop

The sequence of popped out values are

a) 2, 2, 1, 2, 1 b) 2, 2, 1, 1, 2

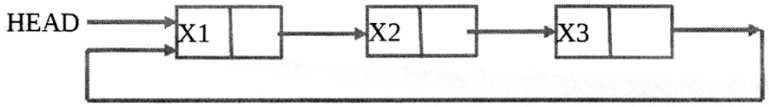
c) 2, 1, 2, 2, 1 d) 2, 1, 2, 2, 2.

ii) The postfix equivalent of the prefix * + *ab* – *cd* is

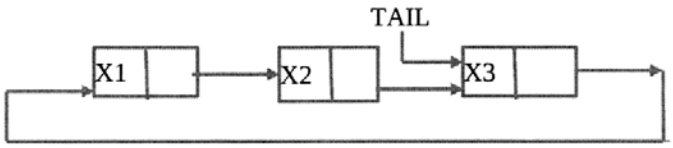
a) *ab* + *cd* – * b) *abcd* + – *

c) *ab* + *cd* * – d) *ab* + – *cd* *

iii) There could be two representations of a circular linked list. In the first representation the list is identified by a pointer pointing to the beginning of the list as shown below :



In the second representation, the list is identified by a pointer pointing to the end of the list as shown below :



Which of the following statements is *not* true about these two representations ?

a) In the first representation, insertion at the front (*i.e.* before the node *X*1) requires traversing the list

b) In the first representation, insertion at the rear (*i.e.* after the node *X*3) requires traversing the list

c) In the second representation, insertion only at the front (and not at the rear) does not require traversing the list

d) In the second representation, insertion at any end (front and rear) does not require traversing the list.

iv) How many different trees are possible with 4 nodes ?

a) 14 b) 15

c) 16 d) 17.

v) Let $T(n)$ be the function defined by $T(n)=2T(n/4)+\sqrt{n}$.

Which of the following statements is true ?

a) $T(n)=O(\sqrt{n})$ b) $T(n)=O(\sqrt{n}\log n)$

c) $T(n)=O(\log n)$ d) None of these.

vi) Maximum possible height of an AVL tree with 7 nodes is

a) 5 b) 4

c) 3 d) none of these.

vii) Which of the following is a hash function ?

a) Open addressing b) Folding

c) Quadratic probing d) Chaining.

viii) What are the notations used in Evaluation of Arithmetic Expressions using prefix and postfix forms ?

a) Polish and Reverse Polish notations

b) Polish notation

c) Reverse polish notation

d) None of these.

ix) In an AVL tree, at what condition the balancing is to be done ?

a) If the 'pivotal value' (or the 'Height factor') is greater than 1

b) If the 'pivotal value' (or the 'Height factor') is less than –1

c) If the 'pivotal value' (or the 'Height factor') is greater than 1 or less than –1

d) None of these.

x) What is the bucket size, when the overlapping and collision occur at same time ?

a) One b) Two

c) Three d) Four.

xi) The memory address of the first element of an array is called

a) floor address b) foundation address

c) first address d) base address.

xii) Queue can be used to implement

a) radix sort b) quick sort

c) recursion d) depth first search.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following $3 \times 5 = 15$

2. Consider the following recursive *C* function to compute X^n[*eg.* $2^3 = 8$] :

```
int Power (int x , int n)
{
    if (n == 0) return 1;
    if (n == 1) return x;
    if (n%2 == 0)
         return Power (x*x, n/2);
    return (x*Power(x*x,n/2));
}
```

Find the recurrence relation of the above function to compute $T(n)$ [$T(n)$ is the time complexity]. Deduce the recurrence relation and find the time complexity in order notation (big-Oh). 2 + 3

3. The Pre-order and In-order traversal sequence of nodes in a binary tree are :

Preorder : *A B C D E F G H I*

In-order : *C B E D G F A H I*

Construct the tree.

4. What are the types of Collision Resolution Techniques and the methods used in each of the type ?

5. What is a Spanning Tree ? Does the minimum spanning tree of a graph give the shortest distance between any 2 specified nodes ?

6. Compare insertion sort, heap sort and quick sort according to the best case, worst case and average case behaviours.

GROUP – C

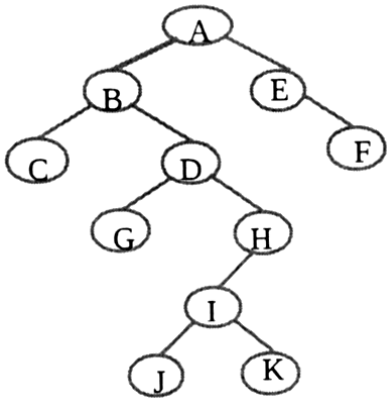
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) What is recursion ? Write a recursive routine in *C* to print the single linked list in reverse order. 1 + 4

   b) Write a *C* function to insert a node in a binary search tree. 4

   c) Assume the following tree has all the property of binary search tree :



   Now delete *D*, from the above tree and redraw the tree. 2

d) Create a heap from the following sequence of nodes :

80, 20, 90, 40, 100, 60, 120, 60, 50, 70 4

8. a) Sort the following list in ascending order using Quick sort [show only the first pass] : 3

35, 75, 45, 90, 30, 40, 12, 15, 8, 10

b) What happened when all the array elements are same in quick sort ? Explain with example. Find the time complexity for such a case. 3 + 4

c) Write a *C* function of shell sort. 5

9. a) Find the average case time complexity of Linear search.

2

b) Write an algorithm of Binary search. What is the time complexity of this search in best case ? 4 + 1

c) What do you mean by Hashing ? Describe any three hash function with suitable examples. Explain any two methods of dealing with hash collision. 1 + 3 + 4

10. a) Write down the algorithm to implement PUSH ( ) and POP ( ) operation using linked list.

b) What is the real life implementation of Queue ?

c) Implement insert and delete operations using array on simple queue. 7 + 2 + 6

11. Write short notes on any *three* of the following : 3×5

a) Threaded Binary Tree

b) Knuth-Morris Pattern Matching Algorithm

c) TRIE data structure

d) Garbage Collection and Compaction

e) Huffman Algorithm.

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