Name : ……………………………………………………

Roll No. : …………………………………………………

Invigilator's Signature : ……………………………….…

CS/B.TECH (FT-OLD)/SEM-4/CS-415/2013

2013

DATA STRUCTURE & ALGORITHMS

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) Consider the following two functions :

$f(n) = n^3$,   if $0 \le n < 10,000$

    $= n^2$ otherwise

and

$g(n) = n$,   if $0 \le n < 100$

    $= n^2 + 5n$ otherwise

Which of the following is true ?

a) $f(n)$ is $O(n^3)$

b) $g(n)$ is $O(n^3)$

c) $O(f(n))$ is same as $O(g(n))$

d) $g(n)$ is $O(n^2)$.

ii) The expression which accesses the (ij)th entry of a $m * n$ matrix stored in column major form is

   a) $n * (i – 1) + j$ b) $m * (j – 1) + i$

   c) $m * (n – j) + j$ d) $n * (m – i) + j$.

iii) The minimum number of fields with each node of doubly link list is

   a)   1   b)   2

   c)   3   d)   4.

iv) The prefix expression for the infix expression

      $A + B* (C + D) / F + D*E$

    is

   a) $AB + CD + *F/D + *$

   b) $ABCD + *F/+ DE* +$

   c) $A * B + CD/F* DE ++$

   d)   none of these.

v) Stack is useful for implementing

   a)   Radix sort

   b)   Breath first search

   c)   Recursion

   d)   Depth first search.

vi) Which of the following data structures may give an overflow error, even though the current number of elements in it is less than its size ?

   a)   Simple queue   b)   Circular queue

   c)   Stack   d)   none of these.

vii) Which of the following statements is false ?

    a)   Every tree is a bipartite graph

    b)   A tree contains a cycle

    c)   A tree with n nodes contains ($n - 1$) edges

    d)   A tree is a connected graph.

viii) Identify the correct statements about the AVL tree.

    i)   In the tree height of two sub-trees of every node never differ by not more than one

    ii)   Balance factor of each node is – 1, 0, 1

    iii)   The maximum height of a balance binary search tree is $1.44 \log_2 4$.

    a)   (i) & (ii)   b)   (ii) & (iii)

    c)   (i) & (iii)   d)   All of these.

ix) Number of vertices of odd degree graph is

    a)   always even   b)   always odd

    c)   either even or odd   d)   always zero.

x) Consider that n elements are to be sorted. The worst case complexity of Bubble sort is

    a) $O(1)$ b) $O(\log_2 n)$

    c) $O(n)$ d) $O(n^2)$.

xi) Merge sort uses

    a)   divide and conquer strategy

    b)   backtracking approach

    c)   heuristic search

    d)   greedy approach.

xii) The best sorting method if the number of swapping done is the only measure of efficiency is

    a)   bubble sort   b)   selection sort

    c)   insertion sort   d)   heap sort.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2.   a)   Explain $f(n) = O(g(n))$.

     b)   What are the advantage and disadvantages of Binary search over Linear search ?   2 + 3

3.   a)   What is stack ?

     b)   Write the algorithm of POP and PUSH of stack.   1 + 4

4.   Write a *C* function to reverse a linked list physically.

5.   Construct a Binary Search Tree with the help of the following in-order and post-order traversal :

     Post-order : G,E,C,A,B,D,F,L,J,I,K,M

     In-order : A,B,C,D,E,F,G,I,J,K,L,M

6.   a)   What is hashing ? Why is it used ?

     b)   Explain the chaining method of collision resolution in hashing.   2 + 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

7. a) The in-order and pre-order traversal sequence of nodes in a binary tree are given below :

    In-order : H D B I E A F J C K G L

    Post-order : H D I E B J F K L G C A

    Draw a binary tree. Briefly state the logic to construct the tree.

    b) Explain with a suitable example, the principal operation of Quick sort.

    c) Find out the complexity of binary search.   7 + 5 + 3

8. a) Convert the following infix expression into its equivalent postfix expression using stack.

    (A + B) * C – (D – E) / F

    b) Write down an algorithm (or function) to insert an item into a simple queue.

    c) Construct the following queue of characters where queue is a circular array which is allocated seven memory cells.

    FRONT=2, REAR = 4; QUEUE : …. ABC ….

    Describe the queue as following operations take place sequentially :

    i)   E is added to the queue

    ii) Three letters are deleted from the queue

    iii) G, H, I are added to the queue

    iv) Two letters are deleted from the queue

    v)   X is added to the queue.   5 + 5 + 5

9. a) Construct an AVL tree by inserting the following elements in order of their occurrence and show the rotations.

65, 2, 15, 27, 14, 111, 99, 86

b) What is complete binary tree ? What is threaded binary tree ?

c) What is the advantage of circular queue over simple queue ? What is output restricted de-queue ?

d) Prove that the maximum number of nodes in a binary tree on level i is 2^i. 5 + 4 + 4 + 2

10. a) Find out the minimum cost spanning tree in the given graph by Prim's algorithm.
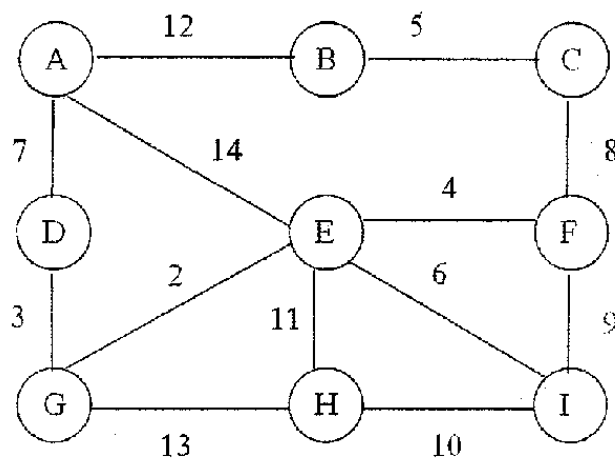
b) What are the various ways of representation of graph in memory ? Explain each of them.

c) What is hashing ? Explain linear probing and quadratic probing with example. 5 + 5 + 5

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

    a) DFS

    b) PUSH and POP algorithm of stack

    c) Kruskal's Algorithm

    d) Tail recursion

    e) B-tree.

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