Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.TECH(FT-OLD)/SEM-4/CS-415/2012

2012
DATA STRUCTURE AND ALGORITHM

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 answers of the following : $10 \times 1 = 10$

    i)   The order of complexity of merge sort in best case is

        a) $O(n)$ b) $O(n^2)$

        c) $O(n \log n)$ d) $O(\log n)$.

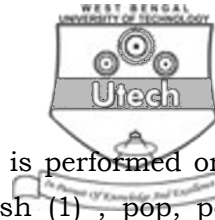   ii)   Which one out of the following works on "Divide and Conquer" policy?

        a)   Selection sort   b)   Heap sort

        c)   Quick sort   d)   All of these.

    iii)   Infix equivalent of the prefix */+ABCD is

        a)   A + B /C*D   b)   A+(B*C)/D

        c)   A+(B/C)*D   d)   (A+B)/C*D.

4418(O)   [Turn over

iv) The following sequence of operations is performed on a stack : push (1), push (2), pop, push (1) , pop, pop, push (2), and push (1), pop, pop. The sequence of popped out values are

    a)   2,1.2,1,1   b)   2,1,1,1,2

    c)   1,2,1,1,2   d)   1.1,1.2,2.

v) The maximum number of nodes in a binary of height 5 is

    a)   32   b)   30

    c)   10   d)   31.

vi) How many edges are there in a complete connected graph with n nodes ?

    a) $n(n-1)$ b) $n(n-1)/2$

    c) n^2-1 d) $2n-1$.

vii) Elements of a binary search tree will be in sorted order in case of .... traversal.

    a)   In-order   b)   Pre-order

    c)   Post-order   d)   Level order.

viii) In what tree, for every node the height of its left sub-tree and right sub-tree differ at least by one ?

    a)   Binary search tree   b)   Threaded binary tree

    c)   Complete binary tree   d)   AVL tree.

ix) Which data structure is used for breadth first traversal of graph ?

    a) Stack

    b) Queue

    c) Both stack and Queue

    d) None of these.

x) A vertex of degree one is called

    a) Isolated vertex   b) Null vertex

    c) Pendant vertex   d) Colored vertex.

GROUP – B

(Short Answer Type Questions)

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

2. In a two dimensional array 10 × 9 with each element occupying 4 bytes of memory with the address of the first element [1, 1] is 1000. Find the address of [6, 8] for both Row-major and Column-major cases.   5

3. a) If N_0 be the total number of leaf nodes and N_2 be the total number of nodes having two children in a binary tree then prove that $N_2 = N_0 - 1$.

   b) What is BST ? 4 + 1

4. a) What are the applications of stack ?

   b) Write an algorithm to insert an item in the beginning of a linked list. 2 + 3

5. Give an algorithm to search an element in an array using binary search. 5

6. a) How can a polynomial such as $10a^5 - 3a^3 + 6a^2 + 9$ be represented by a linked list ?

   b) Write down the overflow condition of circular queue.

   4 + 1

GROUP – C

(Long Answer Type Questions)

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

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 there 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.
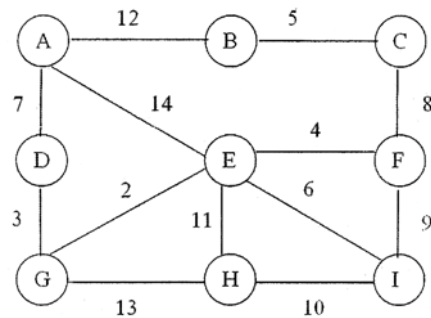
b) What are the various ways of representation of graph in memory ? Explaion each of them.

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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