WEST BENGAL UNIVERSITY OF TECHNOLOGY

MCA-203

DATA STRUCTURES WITH C

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions. 10×1 = 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, 1, 2, 2, 1
(C) 2, 2, 1, 1, 2 (D) 2, 1, 1, 2, 2

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

(A) ab + cd – * (B) ab + cd * –
(C) abcd + – * (D) ab + – cd *

(iii) 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) $T(n) = O(\log n)$
(C) T(n) = O($\sqrt{n}$ log n) (D) None of these

(iv) Which of the following is a hash function?

(A) Open addressing (B) Quadratic probing
(C) Folding (D) Chaining

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

(A) Polish and Reverse Polish notations
(B) Reverse Polish notations
(C) Polish notations
(D) None of these

(vi) Queue can be used to implement

(A) Radix sort (B) Recursion
(C) Quick sort (D) Depth First Search

(vii) What will be the output of the following code?

```
int main( )
{
    void fn( );
    fn( );
    return 0;
}
void fn( )
{
    fn( );
}
```

(A) Compilation error (B) Infinite time execution
(C) Stack overflow problem (D) None of these

(viii) The preorder and post-order Traversal of a binary tree generates the same output. The tree can have maximum

(A) Three nodes (B) One node

(C) Two nodes (D) Any number of nodes

(ix) What kind of data structure do you prefer for implementation of polynomial?

(A) Array (B) Tree

(C) Linear Linked List (D) Graph

(x) Tail recursive function means

(A) A function where last statement is a recursive call

(B) A nested function

(C) A function with an infinite loop

(D) None of these

(xi) Sparse matrix is

(A) All 0 element matrix (B) Mostly 0 element matrix

(C) A unit matrix (D) A few 0 element matrix

(xii) A is an array of size m * n, stored in the row major order. If the address of the first element in the array is M, the address of the element A(i, j) (A(0, 0) is the first element of the array and each element occupies one location in memory) is

(A) $M + (i - j) * m + j - 1$ (B) $M + (j - 1) * m + i - 1$

(C) $M + i * m + j$ (D) $M + (i - 1) * n + j - 1$

GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. The Pre-order and In-order traversal sequence of nodes in a binary tree are: 5
Pre-order: A B C D E F G H I
In-order: C B E D G F A H I
Construct the tree.

3. Compare insertion sort, heap sort and quick sort according to the best case, worst case and average case behaviors. 5

4. Compare linked list with array in respect to both advantages and disadvantages. 5

5. What is tail recursion? How is it different from ordinary recursion? What are the differences between iteration and recursion? 1+2+2

6. Write the push( ) and pop( ) functions for a stack after describing the data structure clearly. 5

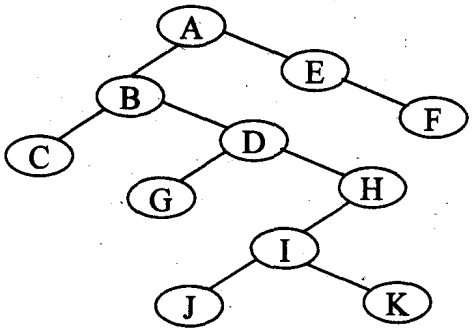
GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. (a) What is recursion? Write a recursive routine in C to print the single linked list in reverse order and count the number of node. 1+6

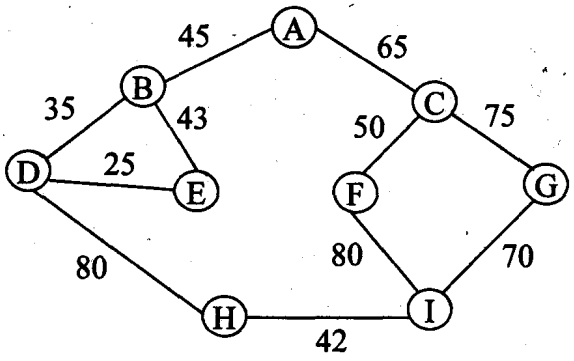
   (b) Write an algorithm for deletion of an element from BST (Include all the cases). 7

(c) Assume the following tree has all the property of binary search tree: 1



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

8. (a) Obtain the minimal spanning tree formed using Kruskal's algorithm for the following graph. 7



(b) Write the algorithm of Heap sort. 6

(c) Explain the time complexity of Heap sort. 2

9. (a) Find the average case time complexity of Linear search. 2

(b) Write an algorithm for 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 functions with suitable examples. Explain any two methods of dealing with hash collision. 1+3+4

10.(a) Are recursive routines more efficient than non-recursive routines? Justify your answer with example. 3

(b) How a polynomial such as $6x^4 + 2x^3 + x + 3$ can be represented by a linked list? Write an algorithm that reads such a polynomial, take derivative of the polynomial and print the result. 2+6

(c) Write a function in *C* to evaluate a postfix expression. 4

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

(a) Sparse Matrix and its' representation

(b) Priority queue

(c) Dequeue-operation and its application

(d) Importance of Garbage collection and compaction

(e) AVL Tree