S.E. Semester – I Examination, 2010
Computer Engineering
DATA STRUCTURES AND ALGORITHMS
(2003 Course)

Time : 3 Hours   Max. Marks : 100

Instructions :   1) Answer **three** questions from Section **I** and **three** questions from Section **II**.
2) Answers to the **two** sections should be written in **separate** books.
3) **Neat** diagrams must be drawn **wherever** necessary.
4) Black figures to the **right** indicate **full** marks.
5) **Assume** suitable data, if **necessary**.

SECTION – I

1. a) Define the following terms and explain with **one** example of **each**.   10

   1) Data

   2) Data Object

   3) Data type

   4) Abstract Data Type

   5) Data Structure.

   b) Write pseudo 'C' code to merge two sorted arrays A[1 : n] and B[1 : m] into C[1 : n + m] such that resulting array C is also sorted.   6

                                             OR

2. a) What are the different algorithm design tools used ? Explain the use of these tools for selection sort.   8

   b) Explain in brief with one example **each** of the following :   8

       i) Primitive/Non-primitive data structures

       ii) Linear/Non-linear data structures

       iii) Static/Dynamic data structures

       iv) Persistence/Ephemeral data structures.

3. a) Explain how two dimensional array A[1 : m, 1 : n] is represented in computer memory using Row Major representation and obtain a formula for computing the address of any element A[i, j], where $1 \leq i \leq m$ and $1 \leq j \leq n$. **8**

   b) Define data structures required to represent the following polynomial,
      i) Using two dimensional array and
      ii) Using structure to represent any term of the polynomial.
      Polynomial $p(x, y) = 3x^8 + 8x^2y + 2xy^2 + 4y^3 + 10$

   Compute the storage (bytes) required for both of these representations used to store the above polynomial in computer memory, assuming 2 bytes are required to store an integer. **10**

   OR

4. a) Write pseudo 'C' code to compute the transpose of a given sparse matrix using fast transpose method and obtain time and space complexity of your algorithm. **10**

   b) What are the advantages and disadvantages of using arrays ? Explain. **4**

   c) Explain the necessity of computing transpose in case of sparse representation of sparse matrices. **4**

5. a) Write pseudo 'C' code to check for well-formed parenthesis for a given arithmetic expression using stack. **6**

   b) Write an algorithm to covert given infix expression to its postfix form using stack. **6**

   c) Write short note on Multi-stack. **4**

   OR

6. a) What is parsing ? Explain the use of stack in parsing of an arithmetic expression. **6**

   b) Write pseudo 'C' code to evaluate a given postfix expression using stack. **6**

   c) Evaluate following postfix expression using stack. Assume that given expression contains only single digit operands. Show the contents of stack for every step. **4**

   Postfix Expression : 42/4+5*2

SECTION – II

7. a) Define Queue. Explain Queue simulation as an application of data structure Queue.   6

   b) What are the problems faced while implementing Linear Queue ? Explain how these problems can be resolved ?   6

   c) Write an ADT for circular Queue.   4

OR

8. a) Explain how multiple queue can be implemented using single array ? Explain any one real world application of Multi-queue.   6

   b) Explain job scheduling based on priority of a job as an application of priority Queue.   6

   c) Write short note on Double Ended Queue.   4

9. a) Write pseudo 'C' code for insertion sort for non-increasing sort order. What are the Worst and Best cases for it ? Obtain time and space complexities for each case.   8

   b) Sort the following numbers stored in an array in non-decreasing order using Quick Sort. Show the contents of array and partitions at the end of each iteration.   6

   80, –20, 45, –6, 11, 79, 41, 92

   c) What do you mean by sort stability ? What precaution you will take to make the insertion sort stable ?   4

OR

10. a) Write pseudo 'C' code to implement Binary Search using recursion. Specify the Worst and Best cases for it, and obtain time and space complexities for each case.   8

    b) Write pseudo 'C' code to sort an array of size 'n' in non-increasing order using Shell Sort. Assume that array contains integer numbers. What is it's time complexity ?   6

    c) What is the need of sorting in computer applications ?   4

11. a) "Frequency Count is the only important factor while analyzing an algorithm for its efficiency" Justify. **6**

b) Explain how Dynamic Programming approach differs from Divide and Conquer and Greedy approaches. **6**

c) Give all possible solutions using Backtracking for 4-queen problem. **4**

OR

12. a) Explain O, Ω and θ notations used in analysis of algorithms. **6**

b) State 'Tower of Hanoi' problem and write pseudo 'C' code to solve it. **6**

c) State the characteristics of "Greedy Strategy". **4**