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**P.E.S. College of Engineering, Mandya - 571 401**  
*(An Autonomous Institution affiliated to VTU, Belgaum)*  
**Third Semester, B.E. - Computer Science and Engineering**  
**Semester End Examination; Dec. - 2014**  
**Data Structures with C**

*Time: 3 hrs*

*Max. Marks: 100*

*Note : i) Answer FIVE full questions, selecting ONE full question from each Unit.  
 ii) Assume suitable missing data if any..*

**Unit - I**

1. a. Define data structure. Discuss with an example for each, how data structures are classified. 6
- b. What is last-in-first out data structure? What are the various operations associated with it? 4  
What are its applications?
- c. Write an algorithm for converting a parenthesized infix expression to postfix expression. 10  
Trace the algorithm indicating the content to stack for the expression  $((a + b) * c) * e / f$
2. a. Transform each of the following expression to its other two equivalent forms 10
  - i)  $++A - * \$ BCD / + EF \& GHI$
  - ii)  $+- \$ ABC * D ** EFG$ .
- b. Apply the evaluation algorithm to evaluate the following expression showing the stack content in each step. Assume  $A = 1, B = 2, C = 3, D = 4, E = 5, F = 6, -AABCD - + \$ * EF - +$  5
- c. Write a recursive routines for the following: 5
  - (i) To find the largest element in an array of integers.
  - (ii) To find the sum of all the elements in an array of integers.

**Unit - II**

3. a. List and explain the advantages of linked list representation of data over array representation. 6
- b. Write a routine Search (P, X) that accepts a pointer 'P' to a single linked list of integers and in integer 'X' and returns a pointer to a node containing 'X', if it exists and NULL otherwise. 4
- c. Write 'C' routines to perform the following operations on singly linked list with header node. 10
  - (i) To change the information field of the  $K^{\text{th}}$  node to the value given by X
  - (ii) To delete a node whose information is specified
4. a. What are the disadvantages of SLL? How you can overcome the disadvantages by making it as circular singly linked list? Explain with an example. 6
- b. What is a header node? What are its uses? Explain with an example. 4
- c. Write 'C' routines to perform the following operations on circular DLL with header node. 10
  - (i) To insert a new node to the immediate left of the  $K^{\text{th}}$  node.
  - (ii) To search for a node whose information is specified.

**Unit - III**

- 5 a. Discuss with an example, how long positive numbers are represented using linked list. 5
- b. Write the following routines to perform addition of two long positive numbers. 10  
 (i) Read Number( ) (ii) Display Number( ) (iii) Add Numbers( )
- c. What are the advantages and disadvantages of static memory allocation Vs dynamic memory allocation? 5
- 6 a. What is the disadvantage of an ordinary queue? How can you overcome this disadvantage? Explain with an example. 5
- b. A circular queue of size 5 has three elements 10, 20, 30 (10 is at front and 30 at rear) with  $F = 2$ , and  $R = 4$  values with necessary diagrams while performing the following sequence of operations. (i) Insert 40 and 50 (ii) Insert 60 (iii) Delete two elements (iv) Insert 70. 10
- c. Write the following routines to implement circular queue by defining a queue structure. 5  
 (i) Insert( ) (ii) Delete( ) (iii) Display( )

**Unit - IV**

- 7 a. Define a binary tree? List and explain with an example for each, various types of binary trees. 12
- b. Write recursive routines for various types of traversals of a binary tree. 8
- 8 a. Construct the expression tree for the postfix expression  $632 - 5* + 2 \$ 3 +$  and write its other two forms by in-order and pre-order traversals. 6
- b. What are threaded binary trees? List and explain various types of threaded binary trees with an example for each. 10
- c. Write a recursive 'C' routine to count the number of leaf nodes in a binary tree. 4

**Unit - V**

- 9 a. Write a 'C' program to sort the given elements using Merge sort. 10
- b. Write a 'C' program to sort the elements in ascending order using Heap sort. 10
- 10 a. Write a 'C' program to search an element using probability search. 10
- b. Write a 'C' program to search an element using ordered list search. 10

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