CBCS SCHEME

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18CS32

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Data Structures and Applications

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a.   What is data structure? What are the various types of data structure? Explain.   **(05 Marks)**
    b.   What is structure? How it is different from array? Explain different types of structure declaration with examples and give differences between Union and Structure.   **(10 Marks)**
    c.   Define pointers. How to declare and initialize pointers, explain with example.   **(05 Marks)**

OR

2   a.   Explain dynamic memory allocation functions in detail.   **(06 Marks)**
    b.   Write the Knuth Morris Pratt pattern matching algorithm and apply the same to search the pattern 'abcdabcy' in the text: 'abcxabcdabxabcdabcdabcy'   **(08 Marks)**
    c.   Write a C program to:
         (i)   Comparing strings
         (ii) Concatenate two strings   **(06 Marks)**

Module-2

3   a.   Define stack. Give the implementation of push, pop and display functions. Include check for empty and full conditions.   **(07 Marks)**
    b.   Write the postfix form of the following expressions using stack:
         (i) $A \$ B * C - D + E|F|(G + H)$
         (ii) $A - B | (C * D \$ E)$ **(06 Marks)**
    c.   Write an algorithm to evaluate a postfix expression and apply the same for the given postfix expression. $ABC - D * + E\$F +$ and assume A = 6, B = 3, C = 2, D = 5, E = 1 and F = 7.   **(07 Marks)**

OR

4   a.   Define recursion. Write a recursive functions for the following:
         (i)   Factorial of a number
         (ii) Tower of Hanoi   **(07 Marks)**
    b.   What is the advantage of circular queue over ordinary queue? Write a C program to simulate the working of circular queue of integers using array. Provide the following operations:
         (i)   Insert
         (ii) Delete
         (iii) Display   **(08 Marks)**
    c.   Write a note on Dequeue and priority queue.   **(05 Marks)**

Module-3

5   a.   What is a linked list? Explain the different types of linked lists with neat diagram.   **(07 Marks)**
    b.   Write a C function to insert a node at front and delete a node from the rear end in a circular linked list.   **(08 Marks)**
    c.   Write a C function for the concatenation of two doubly linked lists.   **(05 Marks)**

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OR

6   a.   Describe the doubly linked lists with advantages and disadvantages. Write a C function to delete a node from a circular doubly linked list with header node.   **(08 Marks)**
    b.   For the given sparse matrix, give the diagrammatic linked representation.

$$a = \begin{bmatrix} 0 & 1 & 2 \\ 3 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$ **(04 Marks)**

    c.   Write a C function to add two-polynomials represented as circular list with header node.   **(08 Marks)**

Module-4

7   a.   What is a tree? With suitable example, define:
         (i)   Binary tree
         (ii) Level of the binary tree
         (iii) Complete binary tree
         (iv) Degree of the tree   **(09 Marks)**
    b.   Write the C routines to traverse the tree using:
         (i)   Pre-order traversal
         (ii) Post-order traversal.   **(06 Marks)**
    c.   For the given data, draw a binary search tree and show the array and linked representation of the same: 100, 85, 45, 55, 110, 20, 70, 65.   **(05 Marks)**

8 a. What is the advantage of the threaded binary tree over binary tree? Explain the construction of threaded binary tree for 10, 20, 30, 40 and 50. **(07 Marks)**

b. Define expression tree. For a tree given in Fig.Q8(b) traverse the tree using in-order, preorder and post-order traversals.
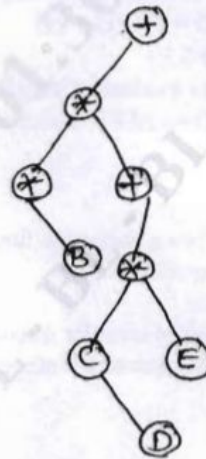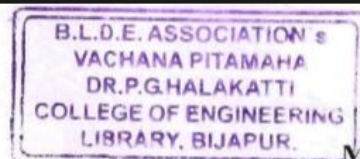

Fig.Q8(b) **(07 Marks)**

c. Construct a binary search tree by using the following in-order and preorder traversals:

Inorder : BCAEDGHFI

Preorder : ABCDEFGHI **(06 Marks)**

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Module-5

9 a. Define graph. For the given graph, show the adjacency matrix and adjacency list representation of the graph [Ref. Fig.Q9(a)]
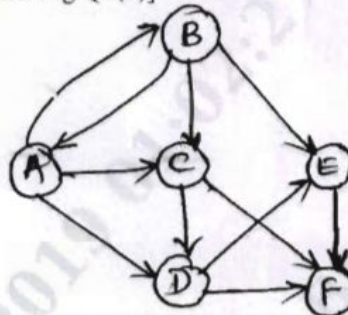

Fig.Q9(a) **(05 Marks)**

b. What are the methods used for traversing a graph? Explain any one with example and write C function for the same. **(08 Marks)**

c. Write a C function for insertion sort. Sort the following list using insertion sort:

50, 30, 10, 70, 40, 20, 60 **(07 Marks)**

10 a. What is collision? What are the methods to resolve collision? Explain linear probing with an example. **(07 Marks)**

b. Explain in detail about static and dynamic hashing. **(06 Marks)**

c. Briefly explain basic operations that can be performed on a file. Explain indexed sequential file organization. **(07 Marks)**

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Data Structures & Applications

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Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Differentiate between Structures and Unions with example. **(05 Marks)**
   b. Explain the functions supported by 'C' to carry out dynamic memory allocation. **(05 Marks)**
   c. Express the given sparse matrix as triplets and find its transpose and also write a fast transpose algorithm to transpose a sparse matrix

$$\begin{bmatrix} 15 & 0 & 0 & 22 & 0 & -15 \\ 0 & 11 & 3 & 0 & 0 & 0 \\ 0 & 0 & 0 & -6 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 91 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 28 & 0 & 0 & 0 \end{bmatrix}$$ **(10 Marks)**

OR

2 a. How would you represent polynomial using array of structures and also write a function to as 2 polynomials. **(10 Marks)**
   b. Find the table and corresponding graph for the second pattern matching algorithm where the pattern is P = ababaab. **(10 Marks)**

Module-2

3 a. Convert the following Infix expression to Postfix expression :
      (i) $((((a/b) - c) + ((d*e)) - a * c)$ (ii) $A - B | (C * D \$ E)$ **(06 Marks)**
   b. Write a function to evaluate Postfix expression. **(08 Marks)**
   c. Define Recursion and Evaluate A(1, 3) using Ackermann's function. **(06 Marks)**

OR

4 a. Explain with suitable example disadvantages of ordinary queue and how it is solved using circular queue, write functions for circular queue insertion and deletion. **(10 Marks)**
   b. Define stack. Give 'C' implementation of PUSH and POP functions. Include check for empty and full conditions of stacks. **(06 Marks)**
   c. Evaluate the following Postfix expression
      $623 + - 382 | + * 2 \$ 3 +$ **(04 Marks)**

Module-3

5 a. Write 'C' function to perform the following :
      (i) Assume a four node single linked list with data value 15, 25, 40, 50
      (ii) Insert a node with data value 30 in between the nodes 25 and 40.
      (iii) Delete a mode with data value '40'.
      (iv) Search a mode with data value '25' **(15 Marks)**

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   b. Write a note on linked representation of sparse matrix. Give linked representation of the given sparse matrix $\begin{bmatrix} 0 & 5 & 3 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ **(05 Marks)**

OR

6 a. Write a note on Doubly linked lists and also write functions to insert at front and delete at front using D.L.L. **(08 Marks)**
   b. Write a function to add 2 polynomials using Single Linked lists. **(08 Marks)**
   c. Write a function to Concatenate 2 Single Linked lists. **(04 Marks)**

Module-4

7 a. With suitable example define the following :
      (i) Binary tree   (ii) Full binary tree   (iii) Almost complete B.T
      (iv) Strict Binary tree   (v) Level of B.T **(05 Marks)**
   b. Create expression tree for the Postfix expression given below.
      $AB/C*D*E+$ and traverse the resulting expression tree using inorder and preorder traversals. **(05 Marks)**
   c. Write a note on Threaded Binary tree for a given Binary tree in Fig.Q7(c), Insert 'r' as a right child of 'S' in a Threaded Binary tree and write the function to insert **(10 Marks)**

Fig.Q7(c)

OR

8 a. Define BST. Write a function to insert an item into BST. **(10 Marks)**
   b. Show that for any non-empty b-tree, if n_0 is the number of leaf nodes and n_2 is the number of nodes of degree 2 than $n_0 = n_2 + 1$. **(05 Marks)**
   c. Write 'C' functions to illustrate copying of binary tree. **(05 Marks)**

Module-5

9 a. Define graph. Give adjacency matrix and adjacency lists for the graph given below Fig.Q9(a) :
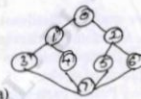

Fig.Q9(a) **(06 Marks)**

   b. Write an algorithm for DFS, show BFS and DFS traversals for the graph given in Q.No.9(a). **(10 Marks)**
   c. Write a note on Hashing functions. **(04 Marks)**

OR

10 a. What is collision? What are the methods to resolve collision? Explain linear probing with an example. **(10 Marks)**
   b. Suppose 9 cards are punched as follows 348, 143, 361, 423, 538, 128, 321, 543, 366. Apply Radix sort to sort them in 3 phases and give its complexity. **(10 Marks)**

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