CBCS SCHEME

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18CS32

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Define data structures, with neat block schematics, explain different types of data structures with examples. **(05 Marks)**

b. Discuss the drawbacks of static memory allocation. Explain how dynamic memory allocation overcome these draw backs, with syntax and examples. Explain colloc( ), malloc( ) and realloc( ) functions. **(08 Marks)**

c. Write a 'C' program to insert an element into an unsorted array based on the position. **(07 Marks)**

OR

2 a. Define pattern matching without using built in function, write a function to
i) To find length of a string
ii) Compare two strings. **(07 Marks)**

b. Define sparse matrix. Express the following matrix in triplet form and find its transpose.

$$A = \begin{bmatrix} 10 & 0 & 0 & 40 \\ 11 & 0 & 22 & 0 \\ 0 & 0 & 0 & 0 \\ 20 & 0 & 0 & 50 \\ 0 & 15 & 0 & 25 \end{bmatrix}$$ **(08 Marks)**

c. Discuss the difference between structures and union. **(05 Marks)**

Module-2

3 a. Define stack. Write a C program to implement the operations of the stack. Demonstrate with diagrammatic representations. **(10 Marks)**

b. Write an algorithm to convert the parenthesized infix expression to postfix form. Convert the following expression to postfix showing the contents of stack (a/(b – c + d)) * (e – a). **(07 Marks)**

c. Write a recursive program to find the GCD of two positive numbers. **(03 Marks)**

OR

4 a. Define queue. Discuss the limitations of ordinary queue. Explain with the diagrammatic representation and 'C' function, the inset and delete operations in circular queue. **(10 Marks)**

b. Evaluate the following postfix expression by showing the contents of stack 56 + 437 - */ **(05 Marks)**

c. Write a recursive program to solve the tower of Hanoi problem. **(05 Marks)**

Module-3

5 a. Define linked list. Write a 'C' function to create a node, insert at front end and delete at rear end of a singly linked list where each node contains name, USN, Branch, semester and phone number of a student. Give the diagramatic representation. **(10 Marks)**

b. Write a C function using doubly linked list.
   i) To insert a node at a specified position.
   ii) To delete a node based on the information field. **(10 Marks)**

OR

6 a. List the advantages of circular singly linked list over singly linked list. Write a 'C' function using circular singly linked list
   i) To insert a node at the end.
   ii) Deletion of node in the beginning. **(10 Marks)**

b. Write a 'C' function to add two polynomials. Show the linked list representation of the polynomial given below along with resultant polynomial.
$P_1 = 3x^3 + 2x^2 + 1x$
$P_2 = 5x^5 + 3x^2 + 7$ **(10 Marks)**

Module-4

7 a. Define binary tree. Prove that a complete binary tree of height n has $(2^{n+1} - 1)$ nodes. **(06 Marks)**

b. Draw the binary search tree for the following input 14, 5, 6, 2, 18, 20, 16, 18, -1, 21. Write a 'C' function to search an element in a binary search tree ignoring supplicate elements. **(10 Marks)**

c. Draw the binary tree for the following traversal
Post order : HIDEBFGCA
In order : HDIBEAFCG. **(04 Marks)**

OR

8 a. List the disadvantages of binary tree. How do you overcome them using threaded binary tree write a 'C' function to implement in order traversal of right in-threaded binary tree with an example. **(10 Marks)**

b. Define expression tree. Write 'C' function to evaluate the expression tree. Evaluate the postfix expression abc - d* + e ^ f + given e = 1, a = 6, b = 3, c = 2, d = 5 and f = 7. **(10 Marks)**

Module-5

9 a. Define graph. Explain with examples the different ways of representing graphs. **(10 Marks)**

b. Write an algorithm to traverse the graph using BFS. Traverse the following graph and print all the vertices reachable considering starting vertex as a. **(10 Marks)**

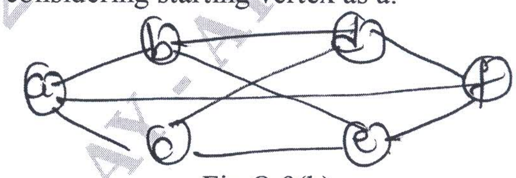

Fig.Q.9(b)

OR

10 a. Write a 'C' program to sort the elements using insertion sort. Trace the program for the elements 25, 75, 40, 10, 20. **(10 Marks)**

b. Define hashing. List the collision resolution techniques. Using open addressing linear probing, explain how the following keys are inserted in the hash table 131, 4, 8, 7, 21, 5, 31, 61, 9, 29. **(10 Marks)**

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