

Third Semester B.E. Degree Examination, Aug./Sept. 2020
Data Structure 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? List and explain the classification of data structures. (05 Marks)
 b. With examples, explain pointer declaration, pointer initialization and void pointer. (05 Marks)
 c. Write the algorithms for inserting an element into a linear Array and deleting from a Linear Array. (10 Marks)

OR

- 2 a. Show the array representation of two polynomials :
 $A(x) = 2x^{1000} + 1$ and $B(x) = x^4 + 10x^3 + 3x^2 + 1$.
 Write a C function to add two polynomial A(x) and B(x) term by term to produce D(x), where $D(x) = A(x) + B(x)$. (10 Marks)
 b. Construct the failure function array for the pattern 'a b c a b y'. Write a C functions for computing the failure functions and KMP pattern matching operation. (10 Marks)

Module-2

- 3 a. Write an algorithm to evaluate postfix expression. Trace the algorithm for the expression 6 5 1 - 4 * 2 3 ^ / + and showing stack contents. (08 Marks)
 b. Write a C recursive function for Tower of Hanoi. Trace the function for 3 disks with call tree diagram. (08 Marks)
 c. Write a C function to implement push and pop functions using arrays. (04 Marks)

OR

- 4 a. Write a C functions for inserting and deleting an element from a circular Queue. (04 Marks)
 b. Write a C function to double the circular Queue capacity dynamically. (06 Marks)
 c. Convert the following infix expression to a postfix expression using stack table :
 i) $a * (b + c) / d - e * f \wedge g$
 ii) $A + B * (C - D / E \$ F) * G$ (10 Marks)

Module-3

- 5 a. Explain the different types of linked list with diagram. (06 Marks)
 b. List advantages, disadvantages and applications of linked list. (04 Marks)
 c. Write the node structure for linked representation of polynomial. Explain the algorithm to add two polynomials represented using linked list. (10 Marks)

OR

- 6 a. Define Linked list. Write a C program to implement insert and delete operation on stack using linked list. (10 Marks)
 b. Represent the following sparse matrix using linked list.

$$\begin{bmatrix} 2 & 0 & 0 & 0 \\ 4 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 \\ 8 & 0 & 0 & 1 \\ 0 & 0 & 6 & 0 \end{bmatrix}$$

(04 Marks)

- c. Write a C functions for following using singly linked list :
- Reverse that list
 - Concatenate two list.
- (06 Marks)

Module-4

- 7 a. Define the following with respect to trees with an example.
- Degree of tree
 - Siblings
 - Leaf nodes
 - Level of a tree
 - Height of a tree.
- (05 Marks)
- b. Write a recursive function to search a key value in a Binary Search Tree. Construct a BST for the given set of values.
14, 15, 4, 9, 7, 18, 3, 5, 16, 20, 17, 9 and perform traverse on it. (10 Marks)
- c. Discuss advantages of threaded binary tree over binary tree and explain threaded binary tree construction with suitable example. (05 Marks)

OR

- 8 a. Define Binary tree. How it is represented using array and linked list? (06 Marks)
- b. Create an expression tree for a given expression $a + b * c - d / e * f$ and write C routines to traverse the tree using in-order, preorder and postorder. (08 Marks)
- c. Write a C function to
- Count number of leaf node in binary tree
 - Find a largest element in BST.
- (06 Marks)

Module-5

- 9 a. Define the following with respect to graphs with an example :
- Connected graph
 - Directed graph
 - Multigraph
 - Complete graph
 - Subgraph.
- (10 Marks)
- b. Write a C routines to implement bfs () and dfs () functions. (10 Marks)

OR

- 10 a. Write a insertion sort algorithm. Explain with an example. (08 Marks)
- b. Discuss division, mid-square and folding hash functions. (07 Marks)
- c. Initially following keys 10,16, 11, 1, 3, 4, 23 and 15 are inserted into an empty hash table of length of 10. Using open addressing with hash function $h(k) = k \text{ mod } 10$ and linear probing. What is the resultant hash table? Explain linear probing. (05 Marks)