NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-15

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

II YEAR B.TECH , SEMESTER EXAMINATION

CSPC32 DATA STRUCTURES

DATE: 08-12-2023 **ANSWER ALL QUESTIONS** **Max Marks: 50**

1. (a) Convert the following prefix expression into postfix and infix expression.

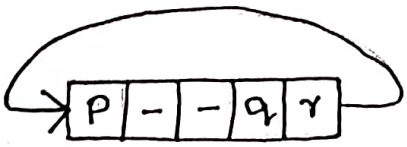
+ - * ^ A B C D / / E F + G H (i.e prefix to postfix and prefix to infix) (2+2)

(b) Let Q denote a queue containing sixteen numbers and S be an empty stack. Head(Q) returns the element at the head of the queue Q without removing it from Q. Similarly Top(S) returns the element at the top of S without removing it from S. Consider the algorithm given below.

```
while Q is not Empty do
    if S is Empty OR Top(S) ≤ Head(Q) then
        x := Dequeue(Q);
        Push(S,x);
    else
        x := Pop(S);
        Enqueue(Q,x);
    end
end
```

What is the maximum possible number of iterations of the while loop in the algorithm? Explain. (3)

(c) Assume the status of the circular queue as in the following figure. What is the status of the queue, if the following sequences of operations are performed. (i) Enqueue '**a**' (ii) Dequeue (iii) Enqueue '**b**' (iv) Dequeue (v) Enqueue '**c**' (vi) Dequeue. (3)



2. (a) Why is XOR linked list considered as a memory efficient double linked list? Discuss with an example. (3)

(b) Write the functions to perform push and pop operations of a stack which is implemented using DLL. (4)

(c) What will be the contents of the list after the function completes execution for the input **1,2,3,4,5,6,7**? (3)

```
struct node {int value; struct node *next;);
void rearrange (struct node *list) {
   struct node *p, *q;   int temp;
   if (!list || !list -> next) return;
   p = list; q = list -> next;
   while (q) {
      temp = p -> value;
      p -> value = q -> value;
      q -> value = temp;
      p = q -> next;
          q = p ? p -> next : 0;
   } }
```

3. (a) The prefix traversal order of a binary tree is ^ + A * B C * + A B C. What is the equivalent postfix expression? (3)

(b) Implement ***setleft*** and ***setright*** functions for a right-pre-threaded binary tree. (2+2)

(c) An AVL tree is constructed by inserting the following sequence of elements into an empty AVL tree: **7, 4, 9, 5 4.5, 6, 5.5, 5.2.** After deleting 4 from the resultant tree, find how many levels are present in the AVL tree. (3)

4. (a) In the same order, insert the following elements into an empty red black tree: C, N, I, Q, T, K, V, J, O. Remove each element in the resulting tree one at a time, keeping the same sequence. (2+2

(b) Considering last element as pivot, sort the following numbers in descending order using quick sort **12,7,15,8,19,20,17,21,5,3**. How many swapping are done to get the sorted list? (3)

(c) Illustrate the operation of radix sort on the following list of English words: COW, DOG, SEA, RUG, ROW MOB, BOX, TAB, BAR, EAR, TAR, DIG, BIG, TEA, NOW, FOX. (3)

5. (a) Breadth First Search (BFS) is started on a binary tree beginning from the root vertex. There is a vertex t at level four from the root. If t is the n^{th} vertex in this BFS traversal, what is the maximum possible value of n? (2)

(b) Let G be a complete undirected graph on 4 vertices, having 6 edges with weights being 1, 2, 3, 4, 5, and 6. What is the maximum possible weight that a minimum weight spanning tree of G can have? (2)

(c) Let G (V,E) be a directed graph, where V = { 1,2,3,4,5} is the set of vertices and E is the set of directed edges as defined by the following adjacency matrix A.

$$A[i][j] = \begin{cases} 1, & 1 \le j \le i \le 5 \\ 0, & \text{otherwise} \end{cases}$$

A[i][j] = 1 indicated a directed edge from node i to node j. A directed spanning tree of G, rooted at $r \in V$, is defined as a subgrapgh T of G such that the undirected version of T is a tree and T contains a directed path from r to every other vertex in V. How many numbers of such directed spanning tree rooted at vertex 5 is possible? (2)

(d) Apply the Warshall's algorithm on the following graph (4)