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Total Number of Pages: 03

**B.TECH**  
**15BE2106**

**2<sup>nd</sup> Semester Back Examination 2016-17**

**DATA STRUCTURE USING 'C'**

**BRANCH: ALL**

**Time: 3 Hours**

**Max Marks: 100**

**Q.CODE: Z464**

**Answer Question No.1 and No.2 which are compulsory and any four from the rest.**

**The figures in the right hand margin indicate marks.**

**Q1 Answer the following questions:**

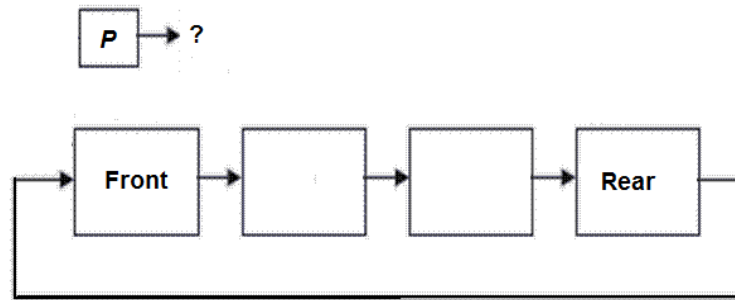
**(2 x 10)**

- a) What do you mean by space and time complexity of an algorithm?
- b) What is a self-referential structure? What are their use?
- c) What are the advantages of linked list over arrays?
- d) What do you mean by internal and external path lengths of a strictly binary tree?
- e) What is a queue? What are the limitations of linear queues?
- f) Between insertion sort and selection sort which one is guaranteed to have the minimum time complexity when all cases (best/worst/average) are considered?
- g) How many pointers are manipulated (changed) while inserting a new node at the beginning of a double circular linked list? Justify your answer.
- h) Consider the two binary operators '\$' and '#' with the precedence of '\$' being lower than the operator '#'. Operator '\$' is left associative while operator '#' is right associative. Draw the expression tree for the expression:  $(7 \# 3 \$ 4 \$ 3 \# 2)$ .
- i) What is an m-way search tree? In what way is it better than the binary search tree?
- j) How a graph can be represented as a linked list?

**Q2 Answer the following questions:**

**(2 x 10)**

- a) What do you mean by ADT? Represent complex numbers as an ADT.
- b) A circularly linked list is used to represent a Queue (as shown in the Fig.). A single variable P is used to access the Queue. To which of the four nodes should P point such that both the operations "Insert" and "Delete" can be performed in constant time? Justify your answer.

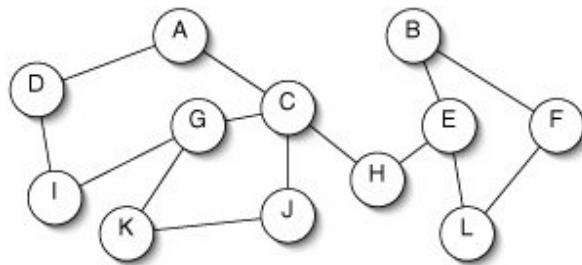


- c) Convert the following postfix expression to prefix expression (Note that ^ is the exponentiation operator):  $8\ 2\ 3\ ^\ / \ 2\ 3\ * \ + \ 5\ 1\ * \ - \ .$
- d) How a binary tree can be represented by using an array?
- e) What are the limitations of array representation of a stack?
- f) Differentiate between strongly connected, weakly connected, and disconnected directed graphs.
- g) A priority queue Q is used to implement a stack that stores characters. PUSH (C) is implemented as INSERT (Q, C, K) where K is an appropriate integer key chosen by the implementation. POP is implemented as DELETEMIN (Q). Justify, which of the following is true. For a sequence of operations, the keys chosen are in:
- Non-increasing order
  - Non-decreasing order
  - Strictly increasing order
  - Strictly decreasing order
- h) Consider the following sequence of integers: 8, 22, 7, 9, 31, 19, 5, 13. How many swaps are required to sort these in ascending order by using quick sort? Assume 8 as the pivot element?
- i) How does the chaining method differ from the linear probing method of collision handling? Which method is better and why?
- j) What do you mean by degree of a vertex in a directed graph?
- Q3** a) What do you mean by recursion? Explain how stacks are useful in implementing recursion. (5)
- b) Discuss the array representation of a Queue. Write C functions to insert an element into the queue and to delete an element from the Queue in its array representation. (5)
- c) Given the following pre-order and post-order traversal results of a binary tree. Construct the binary tree. (5)  
 Pre-order traversal result: A B D G H K C E F  
 Post-order traversal result: G K H D B E F C A
- Q4** a) You have a single linked list containing 8 nodes. Write an algorithm to reverse the node values of the last 5 nodes in the list. (5)
- b) A two dimensional array A[46][30] is represented in row-measure order in memory. Assuming that the matrix is of floating point type and its base address is at 5106, calculate the address of the element A[37][13]. What would be the address of the same element if the matrix is represented in column-measure order? (5)

- c) What is a “Dequeue”? Why are they considered as important data structures? What are the various types of “Dequeues”? (5)
- Q5** a) Write an algorithm to sort the node values of a double linked list in *descending* order. Calculate the time complexity of the algorithm and express it using the “Big-Oh” notation. (8)
- b) Write an algorithm to convert infix expression to prefix expression by using a stack. Convert the following infix expression to it prefix equivalent by using a stack:  $A+(B*C-(D/E^F)*G)*H$ . (7)
- Q6** a) What is a sparse matrix? Explain the three tuple form of representing a sparse matrix. Represent the following sparse matrix in three tuple form. (5)

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 8 \\ 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 3 & 0 & 0 \\ 2 & 0 & 0 & 0 & 5 \end{pmatrix}$$

- b) Write a C function to delete the node *after* a specific node containing an input data in a double circular linked list. (5)
- c) What is an AVL tree? How is it better than a binary search tree? Create an AVL tree using the following node values: 55, 66, 77, 15, 11, 33, 22, 35, 25, 44, 88, 99 (5)
- Q7** a) Write an algorithm for the depth-first traversal of a graph. Show the depth-first traversal result of the following graph. (8)



- b) What is the all-pair-shortest path problem? How does the Warshall's algorithm provide a solution for it? (7)
- Q8** Write short notes on any three (5 x 3)
- B-Trees
  - Binary search
  - Quick sort
  - Hashing