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B.TECH
BE2106

2nd Semester Back Examination 2016-17
DATA STRUCTURE USING 'C'
BRANCH: ALL
Time: 3 Hours
Max Marks: 70
Q.CODE: Z465

**Answer Question No.1 which is compulsory and any five from the rest.**
The figures in the right hand margin indicate marks.

**Q1** **Answer the following questions:** **(2 x 10)**

a) What is a self-referential structure? What are their use?

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.
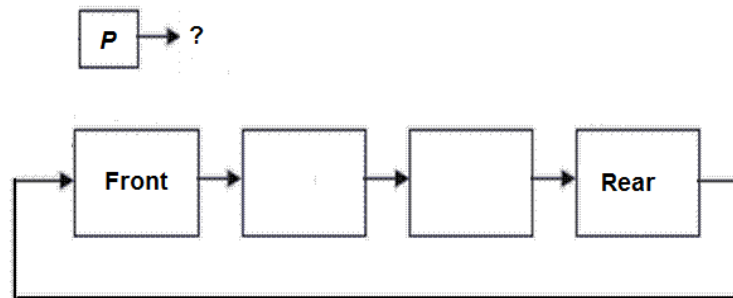
c) A priority queue Q is used to implement a stack that stores characters. PUSH (C) is implemented as INSERT (Q, C, K) where K is an appropriate integer key chosen by the implementation. POP is implemented as DELETEMIN (Q). Justify, which of the following is true. For a sequence of operations, the keys chosen are in:
   (i) Non-increasing order
   (ii) Non-decreasing order
   (iii) Strictly increasing order
   (iv) Strictly decreasing order

d) What do you mean by degree of a vertex in a directed graph?

e) What is a binary search tree? How many different binary search trees can be made with the node values 10, 11, and 12?

f) 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?

g) Between insertion sort and selection sort which one is guaranteed to have the minimum time complexity when all cases (best/worst/average) are considered?

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 do you mean by internal and external path lengths of a strictly binary tree?

j) Differentiate between strongly connected, weekly connected, and disconnected directed graphs.

Q2 a) What are priority queues? Discuss with example how a priority queue can be implemented using a single queue? **(5)**

b) 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

Q3 a) Write a C function to delete the node *after* a specific node containing an input data in a single linked list. Calculate the time complexity of the function and express it using the "Big-Oh" notation. **(5)**

b) A two dimensional array A[50][30] is represented in column-measure order in memory. Assuming that the matrix is of floating point type and its base address is at 4700, calculate the address of the element A[36][21]. What would be the address of the same element if the matrix is represented in row-measure order? **(5)**

Q4 Discuss the array representation of a stack. Write C functions to push an element into the stack, to pop the stack top, and to traverse the stack when the stack is implemented as an array. **(10)**

Q5 a) Write an algorithm to reverse the node values of a single linked list. **(5)**

b) 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)**

Q6 a) Write an algorithm for the breadth-first traversal of a graph. Show the breadth-first traversal result of the following graph. **(5)**
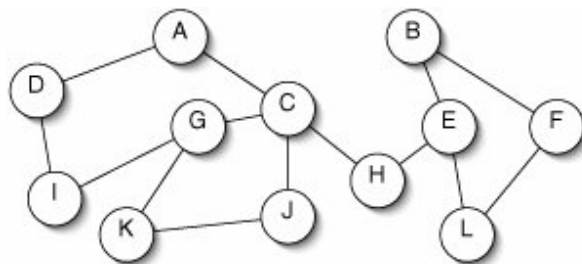
b) Show in steps how to sort the following array of elements by using the Heap-sort method: 9, 6, 8, 7, 21, 14, 15, 19, 13, 12 **(5)**

Q7 a) What is hashing? Explain the different hashing techniques used. **(5)**

b) What is dynamic memory management? How is it performed? Discuss the built-in functions available in 'C' to support dynamic memory management. **(5)**

Q8 Write short notes on any two **(5 x 2)**
a) B+ Trees
b) Warshall's algorithm
c) Merge sort