RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2019

FIRST YEAR [BATCH 2018-21]

Date : 16/05/2019 **COMPUTER SCIENCE (Honours)**

Time : 11 am – 1 pm **Paper : II [Gr. A]** Full Marks : 35

Group - A [35 marks]

1. Answer **any one** question : [1×5]

   a) Each element of an array a[30][40] requires 4 bytes of storage. Base address of array a is 5000. What would be the address/location of a[20][20] when the array is stored as row-major and column-major order. [5]

   b) Give an efficient implementation for a data structure Queue_Min to support an operation find min that reports the current minimum among all elements in the Queue. Usual Queue operations (isEmpty, isFull, Enqueue, Dequeue) are also to be supported. [2·5+2·5]

Answer **any three** questions from **Question Nos. 2 to 6** : [3×10]

2. a) Suppose you have a Twitter account. You want to retrieve the latest tweet among a list of tweets for each person you are following in O(1) time. Suggest an efficient data structure for the above scenario. Write down the Algorithm. [2.5]

   b) Convert the following infix expression to its equivalent postfix notation. [2.5]

$$\frac{B*\left[A/C*\left(D-E\right)\right]}{F*\left(G-H\right)}$$

   c) Implement circular queue as linked list and perform the following operation in a circular linked list:

      (i) Insert an element into the circular queue

      (ii) Delete an element from the circular queue. [2+2]

   d) What is input restricted dequeue? [1]

3. a) Let X be a problem. There exists two algorithms Algo1 and Algo2 to solve the problem X in O(n) time. How do you judge which one between them is a better algorithm? [2]

   b) Define stack as an ADT. [2]

   c) Write a program in C to implement a comparison sort, meaning that it can sort items of any type for which a "less-than" relation (formally, a total order) is defined. It should be a stable sort, meaning that the relative order of equal sort items is preserved. In the *worst* case, this sort does about 39% fewer comparisons than quicksort does in the *average* case. In terms of moves, It's worst case complexity should be O(n log n). If the running time of this sort for a list of length n is $T(n)$, then the recurrence $T\left(n\right)=2T\left(n/2\right)+n$ follows from the definition of the algorithm. [6]

4. a) "There is a simple way to use a Doubly linked list to implement both Enqueue and Dequeue operations in O(1) time" true or false? Justify. [3]

   b) (i) Define spare matrix by giving a suitable example. [1]

      (ii) Write an algorithm to transpose a sparse matrix. [3]

c) Apply the quick sort algorithm for data set 6, 0, 2, 4, 1, 3, 7. Consider the first element as a Pivot element. Give all the steps of sorting. [3]

5. a) Given an array of *n* integers, outline an algorithm for reversing the contents of the array without using another array. You may use one temporary variable. [3]

b) What do you mean by Internal and External Sort? [2]

c) Write an algorithm to convert an infix expression to postfix using stack. [5]

6. a) Merge sort is a stable sort – justify your answer. [2]

b) Write function to implement following operations:

(i) 'Enqueue' operation in a queue using Doubly Linked List. [2.5]

(ii) 'Pop' operation in a stack using Singly Linked List. [2.5]

c) Write a C Function to check if a singly linked list is palindrome or not. [3]

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