Code: AC104/AT104   **Subject: DATA STRUCTURES WITH C & C++**

AMIETE – CS/IT (New Scheme)

Time: 3 Hours   **DECEMBER 2018**   **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.
- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1   **Choose the correct or the best alternative in the following:**   **(2×10)**

   a. The reason for using pointers in a C program is
   (A) Pointers allow different functions to share and modify their local variables.
   (B) To pass large structures so that complete copy of the structure can be avoided.
   (C) Pointers enable complex "linked" data structures like linked lists and binary trees.
   (D) All of these

   b. Which one of the following is an application of Queue Data Structure?
   (A) When a resource is shared among multiple consumers.
   (B) When data is transferred asynchronously (data not necessarily received at same rate as sent) between two processes
   (C) Load Balancing
   (D) All of these

   c. How many stacks are needed to implement a queue? Consider the situation where no other data structure like arrays, linked list is available to you.
   (A) 1   **(B)** 2
   (C) 3   **(D)** 4

   d. Which of the following sorting algorithms can be used to sort a random linked list with minimum time complexity?
   (A) Insertion sort   **(B)** Quick Sort
   (C) Heap Sort   **(D)** Merge Sort

   e. In a complete k-ary tree, every internal node has exactly k children or no child. The number of leaves in such a tree with n internal nodes is:
   (A) nk   **(B)** $(n – 1) k + 1$
   (C) $n(k – 1) + 1$ **(D)** $n(k – 1)$

f. What is the output of following function for start pointing to first node of following linked list? 1->2->3->4->5->6

```
void fun(struct node* start)
{
if(start == NULL)
        return;
 printf("%d  ", start->data);

if(start->next != NULL )
        fun(start->next->next);
printf("%d  ", start->data);
}
```

(A) 1 4 6 6 4 1   **(B)** 1 3 5 1 3 5
(C) 1 2 3 5   **(D)** 1 3 5 5 3 1

g. Which of the following statements is/are TRUE for an undirected graph?

P: Number of odd degree vertices is even
Q: Sum of degrees of all vertices is even

(A) P Only   **(B)** Q Only
(C) Both P and Q   **(D)** Neither P nor Q

h. Given the following input (4322, 1334, 1471, 9679, 1989, 6171, 6173, 4199) and the hash function x mod 10, which of the following statements are true?
i. 9679, 1989, 4199 hash to the same value
ii. 1471, 6171 hash to the same value
iii. All elements hash to the same value
iv. Each element hashes to a different value

(A) i only   **(B)** ii only
(C) i and ii only   **(D)** iii or iv

i. Suppose we have a O(n) time algorithm that finds median of an unsorted array. Now consider a QuickSort implementation where we first find median using the above algorithm, then use median as pivot. What will be the worst case time complexity of this modified Quicksort.
(A) O(n^2 Logn)   **(B)** O(n^2)
(C) O(n Logn Logn)   **(D)** O(nLogn)

j. In fopen(), the open mode "wx" is sometimes preferred "w" because.
1) Use of wx is more efficient.
2) If w is used, old contents of file are erased and a new empty file is created. When wx is used, fopen() returns NULL if file already exists.
(A) Only 1   **(B)** Only 2
(C) Both 1 and 2   **(D)** Neither 1 nor 2

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Answer any FIVE Questions out of EIGHT Questions.
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Q.2 a. Write a recursive algorithm for Matrix multiplication.   **(10)**

   b. Write short note on Dynamic Memory Management.   **(6)**

Q.3 a. How to efficiently implement k stacks in a single array?   **(8)**

   b. Explain the implementation of Deque using circular array.   **(8)**

Q.4 a. Write C function to reverse a linked list in group of given size.
       Example:
       Inputs: 1->2->3->4->5->6->7->8->NULL and k = 3
       Output: 3->2->1->6->5->4->8->7->NULL.

       Inputs: 1->2->3->4->5->6->7->8->NULL and k = 5
       Output: 5->4->3->2->1->8->7->6->NULL.   **(8)**

   b. Explain different cases of deletion operation in Doubly Linked List.   **(8)**

Q.5 a. What is threaded binary tree? Write C function for inorder traversal of Threaded
       binary tree.   **(10)**

   b. What is inorder successor? Write an algorithm to find the Inorder successor in
       BST.   **(6)**

Q.6 a. Write an algorithm to find the strongly connected component of a graph.
       Explain with an example.   **(12)**

   b. What is the difference between Kruskal's and Prim's algorithm?   **(4)**

Q.7 a. What is collision in hashing? What are the chances of collision with large table?   **(4)**

   b. What is Separate chaining mechanism in hashing? Explain with an example.   **(12)**

Q.8 a. What is an inversion? Find the time complexity of insertion sort when there are
       O(n) inversions.   **(8)**

   b. Write an efficient program for printing k largest elements in an array using Max
       Heap. Find the time complexity of the program.   **(8)**

Q.9   Write short note on:
       a. Basic operations with file in C.   **(8)**
       b. File name conversion in C.   **(8)**

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