B.Tech.
SEM III ODD SEMESTER EXAMINATION, 2015-2016
DATA STRUCTURES USING C

Time: 3 Hours *Max. Marks: 100*

Note: Attempt All Questions. All questions carry equal marks.

Q1. Attempt **Any Four** parts of the following: **[5 X 4 = 20]**

a) A student wants to implement the Fibonacci series with recursive function. Which data structure will you suggest him? Explain the properties of suggested data structure.

b) It is often seen that in linked list representation of a binary tree null links are more than actual pointers. How can you make use of these null links to make tree traversal more efficient?

c) For any two functions f(n) and g(n), we have f(n)= Θ(g(n)) and f(n)= Ω(g(n)).

d) A student wants to insert an element so that element will take given position in a linked list. Write an algorithm for it.

e) At which location of memory you insert the A[i][j]th element of a row major matrix A. Given that the base address of A is B and element size is b.

f) Write a program in C for implementation of stack pop operation using array.

Q2. Attempt **Any Four** parts of the following: **[5 X 4 = 20]**

a) How many real links are required to store a sparse matrix of 10 rows, 10 columns and 15 non-zero entries.

b) Write the function to insert an element in queue in C language.

c) Convert the string **((P - (Q + R)) * S) $ (T + U)** into postfix string using stack.

d) What do you mean by O(n)? Show that $n^2/2 – 2n = O(n^2)$.

e) A binary tree T has 9 nodes. The in-order and pre-order traversals yield the following sequence of nodes:
In-order: E A C K F H D B G, Pre-order: F A E K C D H G B. Draw the tree T.

f) Implement the Tower of Hanoi problem in C.

Q3. Attempt **Two** parts of the following: **[10X 2 = 20]**

a) Find out the minimum spanning tree of the graph in **Fig. 1** using Prim's algorithm. What will be the cost of that spanning tree?
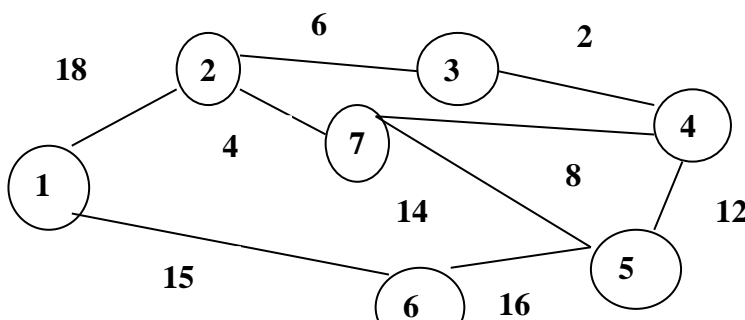

Fig. 1

b) Prove that the number of distinct binary trees having n nodes is $\frac{1}{n+1}\binom{2n}{n}$.

c) Let G=(V,E) be an undirected graph . Let n=|V| and e=|E|. Prove the following:

i) $\sum_{i=1}^{n} d_i = 2e$ where d_i is degree of vertex **i**.

ii) $0 \leq e \leq n(n-1)/2$

Q4. Attempt **Any Two** parts of the following: **[10 X 2 = 20]**

a) Write an algorithm to find All Pairs Shortest Paths in a given graph. Also apply the algorithm in following graph in **Fig. 2**:
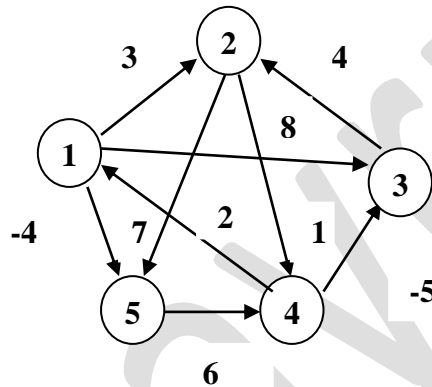

Fig. 2

b) Design an algorithm to verify that given graph is connected. Justify your algorithm with an example.

c) Write a program in C language to implement merge sort.

Q5. Attempt **Any Two** parts of the following: **[10 X 2 = 20]**

a) Sort the following sequence by using bubble sort with proper explanation :

60, 50, 80, 40, 30, 10

b) Write a function in C language for insertion in BST (Binary Search Tree).

c) A person wants to insert the sequence 76, 93, 40, 47, 10, 55 in a hash table of size 7 by using division hash function. Further he decides to use linear probing. Show the positions of each element in the hash table.

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