B.Tech. – VIEP – COMPUTER SCIENCE AND ENGINEERING (BTCSVI)

Term-End Examination

June, 2015

00536

BICS-007 : DATA STRUCTURES

Time : 3 hours *Maximum Marks : 70*

Note : *Question no. **1** is **compulsory**. Answer **four** other questions. All questions carry equal marks.*

1. (a) Define Big O, Theta and Omega notations. Is a function b . log(n) = $O(n^2)$, where b is a positive constant ? Justify.

(b) On what input data does Quick sort algorithm for sorting exhibit its worst case behaviour ? Justify with an example of 8 elements. Determine the maximum space needed.

(c) Prove that all the leaves of a binary tree will be traversed in the same sequence in all the three traversals.

(d) Draw a binary tree whose preorder and inorder traversals are

A B D C E G H I J K F

B D A G E J I K H C F

(e) If the complexity of the algorithm 'doit' can be expressed as $O(n) = n^2$, calculate the complexity of the following program segment :

```
i = 1
loop (i < n)
doit (...)
I = I * 2
```

2+3+3+3+3

2. Define a spanning tree. Write an algorithm to determine maximum spanning tree of a weighted graph. Also argue for the correctness of your algorithm. Also determine the time complexity of the algorithm. Will an edge of highest cost always be in the solution obtained ? *14*

3. (a) What is hashing ? Explain the following terms used in it :

(i) Hashing function

(ii) Synonyms

(iii) Overflow

(iv) Collision resolution

(b) Define an AVL tree. Where is it used and why ? Construct one such tree for the following list of elements :

3, 5, 11, 8, 4, 1, 12, 7, 2, 6, 10 *6+8*

4. (a) A circular singly linked list contains integer elements. Variable pointer points to the last node in the list. Write a procedure to print the positive (not including zero) elements in the list.

(b) Explain three applications each of stacks and queues in Computer science. *8+6*

5. (a) Change the following infix expression to post-fix and prefix expressions.

$$(a - 2 * (b + c) - d * e) * f.$$

Show all the steps. Why is post-fix preferred to infix form ? Which data structure is used for it and why ?

(b) Describe the data structure to represent the following :

(i) Sparse Matrix

(ii) Priority Queue

(iii) Threaded Link

(iv) An algebraic expression of the form :

$$a_n x^n + a_{n-1} x^{n-1} + \ldots\ldots + a_1 x + a_0$$ *7+7*

6. (a) How can a sparse matrix be stored as a linked list so that the element of a given row i and column j can be accessed easily ? Store the following matrix in the suggested format :

0	0	0	0	0	0
1	0	0	0	0	2
0	3	0	0	0	5
0	0	0	4	0	0

(b) Write the procedure to reverse a singly linked list without creating an extra linked list. *7+7*

7. Design a method for keeping two stacks within a single array S (space size) so that neither the stack overflows until all of memory reserved is used and an entire stack is never shifted to a different location within the array. Write C routines for push1, push2, pop1 and pop2 to manipulate the two stacks. *14*

8. Explain the following : *3+3+3+3+2*

   (a) Difference between Class P and Class NP

   (b) Difference between Internal and External sorting

   (c) Difference between Linear and Non-linear data structures

   (d) Different representations of a graph

   (e) Difference between Dynamic Programming and Divide and Conquer approach