EASTERN UNIVERSITY, SRILANKA

SECOND EXAMINATION IN SCIENCE-2004/2005

FIRST SEMESTER (Jan./Feb.,2006)

CS 201 – Data Structures & Design of Algorithms

Answer all questions   **Time: 2Hours**

Q1)

a) What is mean by Binary Search Tree (BST)?

b) Give the Algorithm for Pre-Order traversal in the BST.

c) Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers.

    1. Draw the result tree after inserting the above numbers.
    2. What is the in-order, pre-order traversal sequence of the resultant tree?
    3. What is the height of the tree?
    4. Draw the resultant tree after deleting the node with the value 1.

Q2)

a) Describe briefly the **Two Dimensional Array** data structure *(Definition, Declaration, Accessing the elements and initialization)*.

b) This question deals with Two Dimensional Array (square matrix) and vector. First define the following two data types:
```
#define n 100
typedef int Matrix[n][n]; //Two Dimensional Array data type
typedef int Vector[n];    //One Dimensional Array data type
```

Let A be an $n \times n$ matrix and b a vector of n elements. The product Ab is again a vector of size n and can be computed in the usual manner as taught in your math courses. **Write a function to compute the product Ab**. Do not use any variable other than two indices **i, j**. Assume that A and b are scanned before passing to the function and that they have respective sizes $n \times n$ and n. The product Ab is to be stored in the vector c. You don't have to print the elements of c.

This question continues...

Continuation ...

$$\begin{bmatrix} A_{0,0} & A_{0,1} & .. & A_{0,n-1} \\ A_{1,0} & A_{1,1} & .. & A_{1,n-1} \\ .. & .. & .. & .. \\ A_{n-1,0} & A_{n-1,1} & .. & A_{n-1,n-1} \end{bmatrix} * \begin{bmatrix} b_0 \\ b_1 \\ .. \\ b_{n-1} \end{bmatrix} = \begin{bmatrix} c_0 \\ c_1 \\ .. \\ c_{n-1} \end{bmatrix}$$

Continue your answer with following code....

```
void MatVecMul( Matix A , Vector b, Vector c){
    int i,j;

    /* your code here */
    . . . . . . . . . .
    . . . . . . . .
}
```

Q3)

a) Describe the Stack ADT Data structure.
   1. Give the Definition of Stack ADT.
   2. Name at least 4 operations can be done on Stack ADT?
   3. Name at least two applications which use Stack?
   4. Write an implementation for Stack to hold characters. Continue the bellowed code...

```
#define StackSize 100

class Stack(
    private:
        /* Variable declaration for your Stack*/

        . . . . . . . . . .

    public:
        /* Constructor and your member functions */

        . . . . . . . . . .
};
```

b) Write down the Reverse Polish Notation Algorithm for mathematical expression.

c) Use your above algorithm to convert the following mathematical expression to Reverse polishes notation, $(3 + 4 * 5) - 7 * (1 + 7 / 2)$.
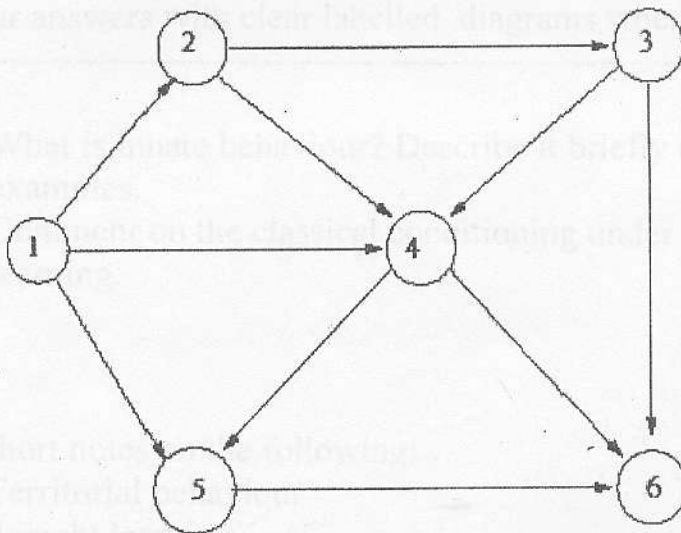
Q4)

a) Define these terminologies.
1. Graphs, Edge, Vertex.
2. Directed graph, Undirected graph, Sub graph.
3. Path, Length.
4. Indegree, Outdegree.

b) Write down the Depth First Search (DFS) Algorithm..

c) Use this graph G(E,V) and answer the following questions.

1. In the graph G(E,V), what are the values of E and V ?
2. Write down the Matrix adjacency for the above graph.
3. By using DFS traversal algorithm, write down the traversal order of the graph from the node 1.