

## Laboratory Examination

Computer Programming Lab (CS 211) Dt: 9/11/07

Full Marks : 40

Time : 3 hrs

Consider a network of  $n$  nodes. A node  $v_i$  could be “directly connected” to a node  $v_j$  by the edge  $e_{ij}$  ( $0 \leq i, j \leq n-1$ ). Our task is to analyze the connectivity of the network. The nodes and the edges form a graph  $(G)$ , with the nodes making the set  $V$  and the edges the set  $E$ .

Write a C program comprising of the following functions:

1. **Read the graph as a matrix:** The program should ask the user information about the nodes to which the node  $i$  is connected. Store the information in the form of a 0-1 matrix,  $M$ . Allocate the memory of the matrix dynamically.

(10 marks)

2. **Compute Boolean Product:** Write a function to compute the Boolean product of two square 0-1 matrices.

(10 marks)

3. **Compute Connectivity Matrix:** Write a function to report if any given node  $i$  is connected to node  $j$  in the network by some path. Note that by “connected” we do not mean a direct connection.

(10 marks)

Hint: Compute  $M^+ = M^1 \vee M^2 \vee M^3 \vee \dots \vee M^n$  and check whether  $M^+[i,j]=1$ .

The symbol  $\vee$  refers to Boolean sum and the powers of  $M$  are obtained by the Boolean product.

You can assume that every node is connected directly to itself and the edges in the graph are directed.

### **Standard Input:**

How many nodes? 3

Node 0 is connected to:

Node 1? Y

Node 2? N

Node 1 is connected to:

Node 0? N

Node 2? N

Node 2 is connected to:

Node 0? Y

Node 1? Y

The program should respond to queries of the type.

Give source node: 2

Give destination node: 1

Output : Connected

Give source node: 1

Give Destination node: 0

Output : Not Connected

*Please comment your codes, indent the code and use functions. Your programming style and clarity of codes will fetch extra credit.*

(10 marks)