School of Information Technology
IIT Kharagpur

Course Id: IT60112 Information and System Security   **Class Test 1**

**Date: February 1, 2007**   **Total Time: 1 Hour**
**Max. Marks: 35**

Instructions: Answer all questions. You may answer the questions in any order. However, all parts of the same question must be answered together. Clearly state any reasonable assumption you make.

1. Consider the following pair of initial and final graphs representing protection states of a system. t and g stand for take and grant rights while α, β and r are arbitrary rights.
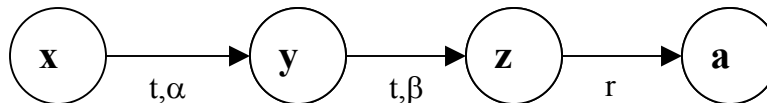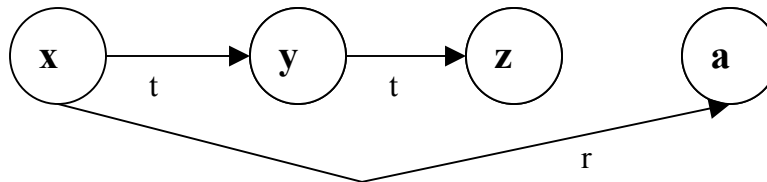
Is there a valid sequence of graph rewriting rules to achieve the final state from the initial state? If yes, draw each intermediate graph, clearly identifying the rule that was applied at each step. If no, clearly explain why it cannot be achieved.   **[8]**

2.
   (a) Why is Bell LaPadula model called a Lattice model of security?
   (b) Given the security clearances/classifications Top Secret (TS), Secret (S), Confidential (C) and Unclassified (U) (ordered from highest to lowest) and categories A, B and C, specify which types of access (read, write) will the following subjects have on the objects under Bell-LaPadula Model (For each subject specify the type of access on each object).

Subject	Object
Ankur (TS, {A, B, C})	firstfile (S,{B, C, A})
Anita (S, {C})	secondfile (C, {B, C})
Atul (S, {A, C})	thirdfile (C, {A, C})
Anil (TS, {A, C})	fourthfile (C, {A})

   (c) If we consider the above clearances/classifications to be integrity levels, then specify which types of access (read, write and execute) will be allowed for the above subjects and objects under Biba's Complete policy (Biba's Model)?   **[4+4+4=12]**

3.

(a) Prove or Disprove the theorem – "If there is an Information Transfer Path from object o_1 $\in O$ to object $o_{n+1} \in O$, then enforcement of the Biba's Ring Policy requires that $i(o_{n+1}) > i(o_1)$ for all $n > 1$ where O is the set of objects and i denotes integrity level."

(b) State Biba's Low Water Mark policy (denoted by LWM2) is such a way that integrity levels of objects decrease instead of that of subjects.

(c) Does the above theorem hold for LWM2? If yes, prove it. If no, give a counterexample.

[5+5+5=15]