



KIBABII UNIVERSITY COLLEGE

(A Constituent College of Masinde Muliro University of Science Technology)

P.O. Box 1699-50200 Bungoma, Kenya

UNIVERSITY REGULAR EXAMINATIONS
2013 /2014 ACADEMIC YEAR
2ND YEAR 2ND SEMESTER EXAMINATIONS
FOR THE DEGREE OF
BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: CSC 373E

COURSE TITLE: SECURITY IN OPERATING SYSTEMS AND DATABASES

DATE: 17TH APRIL, 2014

TIME: 2:00P.M. – 5:00P.M.

INSTRUCTIONS

- Answer **ALL** questions in section A and any **THREE** questions in section **B**
- All questions in section B carry equal marks

Section A 30 Marks Answer ALL questions in this section

Question one (30 marks)

- a)
- i). Describe the THREE dimensions of protection in operating systems [3 marks]
 - ii). Explain the impact of the concept of multiprogramming on operating systems security [2 marks]
- b) For each of the following pairs of terms, define each term, making sure to clarify the key difference(s) between the two terms.
- i). “deadlock prevention” and “deadlock avoidance” [2 marks]
 - ii). “fixed fence” and “variable fence” [2 marks]
- c)
- i). What are the primary mechanisms that an applications programmer can use to ensure correct process synchronization when manipulating shared data? [2 marks]
 - ii). Explain the meaning of a race condition giving an example. [3 marks]
- d)
- i). Consider a user cleared for $\langle \text{secret} ; \{ \text{dog, cat, pig} \} \rangle$ under the military security model. State giving a reason for your answer whether the user will have access to documents classified in each of the following ways [3 marks]
 - I. $\langle \text{top secret} ; \text{dog} \rangle$
 - II. $\langle \text{secret} ; \{ \text{dog} \} \rangle$
 - III. $\langle \text{secret} ; \{ \text{dog, cow} \} \rangle$
 - IV. $\langle \text{secret} ; \{ \text{moose} \} \rangle$
 - V. $\langle \text{confidential} ; \{ \text{dog, pig, cat} \} \rangle$
 - VI. $\langle \text{confidential} ; \{ \text{moose} \} \rangle$
 - ii). Explain the meaning of the term granularity in reference to access control [2 marks]
- e)
- i). Explain the role of the need to know principle
 - ii). Explain how database views can be used to enhance the need to know principle [2 marks]
 - iii). State the four properties that guarantee reliable database transactions [2 marks]
- f) Consider the following confidentiality classification with the security levels from the most sensitive at the top and the least sensitive at the bottom and the associated categorization of users and documents grouped by their security clearances.

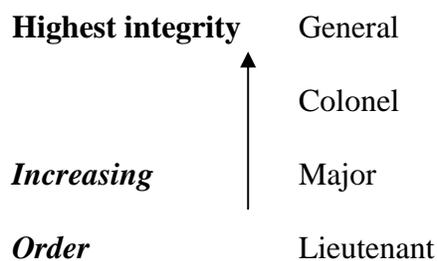
| <u>Confidentiality classification</u> | <u>User categorization by security clearances</u> | <u>Document categorization by security clearances</u> |
|---------------------------------------|---|---|
| TOP SECRET | Tamara | Personal Files |
| SECRET | Sally | Electronic Mail Files |
| CONFIDENTIAL | Claire | Activity Log Files |
| UNCLASSIFIED | Ursula | Telephone List Files |

- i). State the rule used by the confidentiality model to assign file read privileges to users [1 mark]
- ii). Explain the documents read privileges of Tamara and Claire assuming that the discretionary access control allows it. [2 marks]
- iii). Supposing the star property rule (no writing down rule) does not apply and Tamara decides to write personal files content into the activity log files. Explain how this would affect secrecy assuming that discretionary access control is set appropriately. [2 marks]
- iv). State the tranquility rule and explain its importance with respect to security [2 marks]

Section B 40 Marks Answer Any TWO questions in this section

Question Two (20 marks)

- a) To trust any program, we base our trust on rigorous analysis and testing, looking for certain key characteristics explain FOUR such characteristics [4 marks]
- b) One way for a malicious user to gain inappropriate access is to "spoof" users.
 - i). Explain what a spoof is giving an example [2 marks]
 - ii). Explain how trusted systems safeguard against spoofing for critical operations [2 marks]
- c) Several important design principles are quite particular to security and essential for building a solid, trusted operating system. Describe EIGHT of these design principles
- d) In military ranking the integrity level of officer ranks from top to bottom is as shown below



Explain how the Biba model can be applied to ensure that the military chain of command is maintained. [4 marks]

Question Three (20 marks)

- a)
 - i). Explain the meaning of a critical region and describe its role in controlling access to shared resources [3 marks]
 - ii). Explain the THREE requirements of any solution to the critical sections problem stating why they are needed [6 marks]
 - iii). Explain why turn passing is a poor solution to the critical sections problem [2 marks]
- b)
 - i). A semaphore is a blocking synchronization primitive. Describe how they work with the aid of pseudo-code. You can assume the existence of a thread_block() and a thread_wakeup() function. [6 marks]
 - ii). Describe how to implement a lock using semaphores.[3 marks]

Question Four (20 marks)

- a)
 - i). Explain why transaction management is an essential part of multi-user database systems. [5 marks]
 - ii). Evaluate TWO common methods for ensuring integrity of data in concurrent transaction processing, with reference to the following schedule.

| Transaction A | Transaction B |
|---------------|---------------|
| Read (A) | |
| | Read (A) |
| Read (B) | |
| | Read (B) |
| Write (B) | |
| | Write (A) |
| Write (A) | |
| | Write (B) |

[10 marks]

- b) Consider the following Transactions that have been submitted to a DBMS engine concurrently from different user sessions: Session_1 and Session_2.

Session_1: user 1 issues a request to execute the following transaction

USE DATABASE ORDERS

BEGIN TRANSACTION

UPDATE Customers SET ContactName = 'Bill Smith'

WHERE CustomerID = 'ABC'

SELECT ContactName FROM Customers WHERE CustomerID = 'ABC'

ROLLBACK TRANSACTION

SELECT ContactName FROM Customers WHERE CustomerID = 'ABC'

Session_2: user 2 issues a request to execute the following code

USE DATABASE ORDERS

BEGIN TRANSACTION

*SELECT * FROM Customers WHERE CustomerID = 'ABC'*

UPDATE Customers SET ContactName = 'Bill Smith'

WHERE CustomerID = 'ABC'

Explain the affect of each of the following statements in the above transactions. [5 marks]

- SET TRANSACTION ISOLATION LEVEL SERIALIZABLE
- SET TRANSACTION ISOLATION LEVEL READ COMMITTED

Question Five (20 marks)

- a) Large scale database systems, such as distributed database management systems and the Data warehouse, are used in a wide range of industrial and business applications.
- i) Explain what a distributed database management system (DDMS) is and give an example [4 marks]
 - ii) Explain why concurrent control becomes important in the distributed database environment [2 marks]
- b) Explain the purpose of integrity constraints in a database

c) Explain the differences between the following programming constructs that could be used to implement database integrity constraints: [6 marks]

- i) Triggers
- ii) Check Constraints
- iii) Stored Procedures

d) A serious problem for a database manager is the failure of the computing system in the middle of modifying data. Explain how a Two phase update solves this problem [4 marks]

e) What is the purpose of using the following Standard Query Language (SQL) syntax in database security control?

```
GRANT SELECT ON Student_tbl TO PUBLIC;  
GRANT All On Student_tbl To former_student;
```

[4 marks]