

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY  
FACULTY OF APPLIED SCIENCES  
COMPUTER SCIENCE DEPARTMENT  
DECEMBER EXAMINATIONS 2004**

**COURSE:   ADVANCED DATABASE DESIGN & MANAGEMENT  
CODE:     SCS 4201**

**INSTRUCTIONS TO CANDIDATES**

*This examination paper consists of seven (7) questions, all questions carry equal marks.*

*Answer **ALL** questions in **Section A** and **any Two (2)** questions from **Section B***

**3 HOURS**

**SECTION A:**

**QUESTION ONE**

- a) A Harare based organisation runs adult education classes for residents of Harare at a number of adult education centres. Several courses are held at each centre each day during the week. Students may enrol on as many courses as they like provided they pay an enrolment fee at the start of each course. Each course is normally given by a single teacher, but that is not always the case.
- i) Identify the participating entities in this situation.
  - ii) Identify their attributes and relationships between them.
  - iii) Draw an Entity- Relationship diagram showing the relationships between the identified entities. [10]
- b) A relational database is to be created to record the information about the entities and relationships modelled in a) above. Interpret your result in a) and come up with the relation schemas for this database. Ensure that your relation schemas are at least in 2NF. If you make any assumptions in your design, please write them down. Assumptions, however, must not contradict the requirements. [8]
- c) What is the difference between a file organisation and an access method? [2]

### QUESTION TWO

- a) What is importance of the concept of a view in database systems? Discuss the difference between a view and a base relation. [8]
- b) Database design consists of six phases. List the phases. Which of the six phases are considered to be the main activities of the database design process itself and why? [8]
- c) One of the problems with concurrent access to a database is that of the lost update problem. Explain how this arises in a multi user database environment. Use an appropriate example to illustrate your answer. [4]

### QUESTION THREE

- a) What are the design goals of a good relational database design? Is it always possible to achieve these goals? If some of these goals are not achievable, what alternate goals should you aim for and why? [8]
- b) Consider the following six relations for an order-processing database application in a company:

CUSTOMER (Cust#, Cust\_name, City)  
ORDER (Order#, Order\_date, Cust#, Ord\_Amt)  
ORDER\_ITEM (Order#, Item#, Qty)  
ITEM (Item#, Unit\_price)  
SHIPMENT (Order#, Warehouse#, Ship\_date)  
WAREHOUSE (Warehouse#, City)

Here, Ord\_Amt refers to total dollar amount of an order; Order\_date is the date the order was placed; Ship\_date is the date an order is shipped from the warehouse. Assume that an order can be shipped from several warehouses. Specify foreign keys for this relational DB schema, stating any assumptions you make. [6]

- c) What is meant by the term 'client server architecture' and what are the advantages of this approach? [6]

**SECTION B:**

**QUESTION FOUR**

- a) Describe the relationship between mathematical relations and relations in the relational data model. [6]
- b) What is meant by a recursive relationship type? Give three examples of recursive relationship types. [5]
- c) Discuss the organisational integrity, entity integrity and referential integrity constraints. Why is each considered important? [9]

**QUESTION FIVE**

- a) What is union compatibility? Why do the UNION, INTERSECTION, and DIFFERENCE operations require that the relations on which they are applied be union compatible? [4]
- b) Explain the differences between OODB and RDB [10]
- c) Why is it important to have efficient access to a DBMS catalog? [3]
- d) What are the desired properties of a primary key? [3]

**QUESTION SIX**

- a) What is meant by the term relational algebra and what are the fundamental operations in relational algebra? Describe each one of them with illustrations. [8]
- b) With the aid of examples, give an explanation of any two data definition language commands. [6]
- c) Briefly explain the Two-Phase Locking protocol (2PL) and what it achieves. [6]

**QUESTION SEVEN**

- a) Briefly explain the following terms:  
i. Transaction and Transaction support or transaction services  
ii. Concurrency control services  
iii. Recovery services [8]
- b) Describe how these terms in a) support the ACID properties of a transaction. [4]
- c) Explain the concept of serializability and how it is achieved with:  
i) The locking scheme  
ii) Time stamping  
Use appropriate illustrations in your answer. [8]

**END OF QUESTION PAPER**

**GOOD LUCK!**