UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

MAIN EXAMINATION, 2012

Title of Paper   :   **Databases and their Design II**

Course Number   :   CS 346

Time Allowed   :   Three (3) Hours

Instruction   :   **Answer <u>ANY FIVE</u> questions**

This paper should not be opened until permission has been granted by the invigilator.

Question 1

(a)   What are the advantages and disadvantages of using indexes in databases?   [4]

(b)   On relational mainframe DBMSs, who or what is responsible for the decision to use a particular index? What about on microcomputer DBMSs?   [4]

(c)   Why is it a good idea for the DBMS to update the catalog automatically when a change is made in the database structure? Could users cause problems by updating the catalog themselves? Discuss.   [4]

(d)   How can the structure of a table be change in SQL? What general types of changes are possible? What commands are used to implement these changes?   [8]

Question 2

Assume your Inkhundla wishes to design a database for their community library. Initial analysis has determined the following data.

Each library book has a call number, a title, an author, a publisher, and edition. The library may have more than one copy of the same book. Each copy of a book has a copy number, a purchase date and the price. Users of the library are issued library cards. Each user has a card number, name and address. There are two types of library users: *adults* and *children*. Every child has exactly one adult sponsor who must also be a library user. For each student the school and grade must be recorded. Library users may borrow books and for every loan the due date is recorded.

(a)   Draw an ER diagram to illustrate the structure of the above database.   [10]
(b)   Break down the above ER diagram into tables, indicating all special keys.   [10]

Question 3

Using entities found in a library environment like the one in question 2, create an example of a table that is in 1NF but not in 2NF and an example that is in 2NF but not in 3NF. In each case justify your answer – i.e. why you think your 1NF table is not in 2NF, and why your 2NF table is not in 3NF. Normalise your 1NF table to 3NF table(s).   [20]

Question 4

Convert the following table to 3NF

> STUDENT (stud_numb, stud_name, numb_cred, adv_numb, adv_name, crse_numb, crse_desc, grade)

where: stud-numb determines stud_name, numb_cred, adv_numb, and adv_name; adv_numb determines adv_name; the combination of a stud_numb and a crse_numb determines a grade.   [20]

Question 5

(a)   Describe a third normal form and state what types of problems are encountered in tables that are not in third normal form.   [5]

(b)   List the functional dependencies in the following table, subject to the specified conditions. Convert this table to an equivalent collection of tables that are in 3NF

INVOICE(inv_numb, cust_numb, cust_name, address, invdate, part_numb, part_desc, unit_pce, numb_ship)

This table concerns invoice information. for a given invoice (identified by the invoice number) there will be a single customer. The customer's number, name, and address appear on the invoice as well as the invoice date. Also, there may be several different parts appearing on the invoice. For each part that appears, the part number, description, price, and number shipped will be displayed. The prices are from the current master price list.   [15]

Question 6

(a)   (i)   Draw an ER diagram for the following database.

STUDENT (stud_name, stud_id, address, DOB),
COURSE (crse_id, crse_title); ENROLLED-IN(grade)   [5]

(ii)   Illustrate the relationship ENROLLED_IN with a table.   [5]

(b)   Describe aggregation with the aid of an ER diagram where: employees work on a project and use different machines in their work; each employee has a name, and an id-number; the work they do is quantified in hours; the projects they work on are identified by id-numbers and so are the machines they use.   [10]