UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

FINAL EXAMINATION, MAY 2015

Title of Paper	:	**Databases and their Design II**
Course Number	:	**CS 346**
Time Allowed	:	**Three (3) Hours**
Instruction	:	Answer **ANY FIVE** questions

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

Question 1

(a)   Discuss the concept of functional dependency.   [4]

(b)   Compare and contrast a primary key and a referential key.   [4]

(c)   What is partial dependency, and what form is it associated with?   [4]

(d)   Why are normal forms necessary in database design?   [3]

(e)   Discuss the advantages and disadvantages of using indexes.   [5]

Question 2

a)   Define: i) 3NF;   ii) BCNF.   [6]

b)   Why is it a good idea for the DBMS to update its catalog automatically (and not be
       updated by users)?   [3]

c)   What does the term lossless-join dependancy mean?   [3]

d)   Discuss a tabular system, minimally relational and a relationally complete model [8]

Question 3
Suppose we have the following requirements for a University database that is to keep track of
students' transcripts

       a)   The University keeps track of each student's record: name, student's number,
              PIN, current address, permanent address, current phone, permanent phone, date
              of birth, gender, year of study, major department, minor department and degree
              program. Both pin and student number have unique values for each student.
       b)   Each department is described by a name, code, office number, office phone and
              college. Both code and name have unique values for each department
       c)   Each course has a name, description, course number, number of semester hours,
              year offered and an offering department. The course number is unique for each
              course, the course description is known from the course name.
       d)   For every course each student has a grade.

Design a relational database schema for this database application. First show all the functional
dependencies that should hold among the attributes. Then design the relational tables that are in
3NF. Note any unspecified requirements, and make appropriate assumptions to render the
specification complete.   [20]

Question 4

Given the following relations:

Employee(Fname,Minit, Lname, EmplPin, Bdate, Address, Sex, Salary, Super_Pin,Dnum)
Department(Dname, Dnum, Mgr_Pin, Mgr_start_date);   Dep_Loc (Dnum, Dloc);
Project (Pname, Pnum, Ploc, Dnum);   Works_On (Pin, Pnum, Hours)
Dependent (EmplPin, Dependent_name, Sex, Bdate)

a)   Draw an ER diagram for the above database.   [5]
b)   What is a view?   [3]

Consider the following view, EMPL_SUMM, defined on the same database by the SQL query:

CREATE VIEW	EMPL_SUMM (D, C, Total_s, Average_s)
AS SELECT	Dnum, COUNT (*), SUM(Salary), AVG(Salary)
FROM	EMPLOYEE
GROUP BY	Dno

State which of the following queries and updates would be allowed on the view. If the query or update would be allowed, show the corresponding actual query or update that will be executed.

[12]

c)   SELECT   D, C
      FROM   EMPL_SUMM
      WHERE   Total_s>100000;

d)   SELECT   D, Average_s
      FROM   EMPL_SUMM
      WHERE   C>(SELECT C FROM EMPL_SUMM WHERE D=4);

e)   UPDATE   EMPL_SUMM
      SET   D=3
      WHERE   D=4;

Question 5

Consider the table **CUSTOMER**(cust#, cust_name, address, slsr#, slsr_name). Assuming the following functional dependencies:

cust# --> cust_name, address, slsr#, slsr_name
slsr# --> slsr_name

a)   State the reasons why this table is in 2NF?   [3]

b)   The table can be decomposed to the following 3NF tables:
      I.   **CUST_ONE**(cust#, cust_name, address, slsr#)
            CUST_TWO(cust#, slsr_name)
OR   II.   **CUST_1**(cust#, cust_name, address, slsr_name)
            CUST_2(slsr#, slsr_name)

      i)   Prove that both decompositions, I and II, are in 3NF.   [7]
      ii)   Show why these two are based on bad normalization practices   [7]
      iii) Normalize **CUSTOMER** to 3NF properly.   [3]

Question 6

Consider the following relation:

        CAR_SALE(car#, date_sold, salesman#, commision%, discount_amnt)

Assume that a car may be sold by multiple salesman, and hence {car#, salesman#} is the primary key. Additional dependencies are:

        date_sold – –> discount_amnt
        salesman# – –> commission%

a)   Is this relation in 1NF or 2NF? Explain your answer.   **[3]**

b)   Normalise the relation to 3NF.   **[7]**

Consider the following relation for published books

        BOOK(Book_title, AuthorName, BookType, ListPrice, AuthorAffil, Publisher)

The AuthorAfill refers to the affiliation of the author. Suppose the following dependencies exist:

        Book_title – –> Publisher, BookType
        BookType – –> ListPrice
        AuthorName – –> AuthorAffil

c)   What normal form is the relation in? Explain your answer.   **[3]**

d)   Apply normalisation until you cannot decompose the relation further. State the reasons behind each decomposition.   **[7]**