UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

MAIN EXAMINATION, 2008

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) What is partial dependency? What form is it associated with? [4]

(b) Discuss 1NF, 2NF and 3NF with reference to database design. [5]

(c) Discuss the concept of functional dependency. [3]

(d) Why are the normal forms in b) above necessary. [3]

(e) Discuss the execution of a view in SQL with reference to an example. [5]

Question 2

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,

Specify the following queries on the given database in SQL. [8]

a) For each department whose average employee salary is more than 30000, retrieve the department name and the number of employees working for that department.

b) Suppose that we want the number of male employees in each department rather than all employees as in a) above – can we specify this query in SQL? Why or Why not?

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 excecuted. [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 3

Given the following:
A, B —> C, D, E
A —> C
D —> E

a) Identify and discuss each of the indicated dependencies [6]

b) Normalise this database to 2NF then to 3NF [6]

c) Given a new set of functional dependancies of attributes F to L, break it up into two new dependency diagrams one in 2NF and another in 3NF [8]

F, G —> H, I, J, K, L
J —> L
I —> F
H —> G

Question 4

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 name, student's number, pin, current address, permanent address, current phone, permanent phone, birth date, gender, year of study, major department, minor department (if any) 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

d) A grade record refers to a student, a particular course and 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 5

Specify and design a database of your own. The database must consists of at least five entities, and each entity comprise of at least five attributes with three attributes being composite attributes. Make sure to specify all requirements and functional dependencies of your database in the design. [20]

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]