

# UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE & ENGINEERING

*DEPARTMENT OF COMPUTER SCIENCE*

SUPPLEMENTARY EXAMINATION, 2017

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 executed.

- 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

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 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 consist 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  $\twoheadrightarrow$  discount\_amnt

salesman#  $\twoheadrightarrow$  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 AuthorAffil refers to the affiliation of the author. Suppose the following dependencies exist:

Book\_title  $\twoheadrightarrow$  Publisher, BookType

BookType  $\twoheadrightarrow$  ListPrice

AuthorName  $\twoheadrightarrow$  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]