UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

FINAL EXAMINATION, NOVEMBER 2014

Title of Paper : Databases and their Design I

Course Number : CS 345

Time Allowed : Three (3) Hours

Instruction : Answer any **FIVE** questions

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

Question 1
(a) Differentiate between a primary key and a candidate key. **[6]**

(b) Define Entity type, Relationship set and a Domain. **[8]**

(c) Distinguish an object-oriented database from a relational database. **[6]**

Question 2
(a) Discuss any two disadvantages of a DBMS over traditional file systems. **[4]**

(b) Discuss any two advantages and two disadvantages of a relational database system over a hierarchical database system. **[8]**

(c) Define the term redundancy and its implications on a relational database. **[8]**

Question 3
(a) Draw an E-R diagram for our UNISWA community members. Each community member can either be an employee or a student. A community member is described by a name, date of birth, address and a unique personal identity number. Every student identified by a GPA, starting date of program and current year of study. The employees are identified by salaries, departments and positions they are hold. The students are enrolled into courses. The employees have dependencies described by family name (note that these dependencies do not exist without their guardians (employees). **[10]**

(b) Decompose the E-R diagram into its relational schema **[10]**

Question 4
Consider the following database schema:

EMPLOYEE (F-name, L-name, <u>Pin</u>, B-Date, Sex, Salary, Super-Pin, D-no);
DEPT (D-name, <u>D-no</u>, Mgr-Pin, Mgr-Start-Date);
DEPT-LOCATION (<u>D-no, D-Location</u>); WORKS-ON(<u>E-Pin, P-no</u>, Hours);
PROJECT (P-Name, <u>P-no</u>, P-Location, D-no);
DEPENDENT (<u>E-Pin, First-Name</u>, Sex, B-date, Relation).

Specify relational algebra queries to:
(a) Retrieve the names of employees in department 5 who work more than 10 hrs on "**Product-X**" project **[3]**

(b) List the names of employees who have a dependent with the same first name as themselves **[3]**

(c) For each project, list the project name and the total number of hours (by all employees) spent on that project **[3]**

(d) Retrieve the names of employees who do not work on any project **[4]**

(e) Retrieve the average salary of all female employees **[3]**

(f) For each department, retrieve the department name and the average salary of employees working in that department **[4]**

Question 5.

Use a school or university setting to illustrate and emphasize your answers where necessary.

(a)   What are the main operations of relational algebra?   [3]

(b)   What is the Cartesian product? Illustrate your answer with an example.   [5]

(c)   What is the difference between PROJECTION and SELECTION?   [4]

(d)   Explain the difference between natural join and the outer join.   [4]

(e)   Using an example show that the Set Intersection can be done using one of the main operations.   [4]

Question 6

Considering a file structure of the form: JOB (Proj_Num, Proj_Name, Empl_num, Job_Code, Job_Chg_Hour, Proj_Hours, Empl_Phone); where each project is done by more than one employee and each employee works on more than one project; each employee has only one expertise.

(a)   Write an SQL query to create the table described above.   [4]

(b)   Qualify each data type you used in (a).   [4]

(c)   Fit in three rows of data to the given file structure.   [2]

(d)   Identify and discuss the serious data redundancy problems exhibited by a file structure of this form.   [6]

(e)   What problems might you encounter if one of the projects were deleted.   [4]