UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

SUPPLEMENTARY EXAMINATION, JULY 2018

Title of Paper	:	**Databases and their Design I**
Course Number	:	**CSC 272/CS 345**
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 advantages of a DBMS over a traditional file system. **[10]**

(b) Discuss the similarities and differences between a candidate, primary and an alternate key. **[6]**

(c) Define a database. **[4]**

Question 2

(a) Why is data independence so important in relational databases? **[4]**
(b) Draw an E-R diagram ($\geq$ 7 entities) for your desired school environment. **[6]**
(c) Describe a weak entity set with the aid of an example and an ER diagram. **[4]**
(d) Describe data abstraction and, discuss its purpose. **[6]**

Question 3

(a) Distinguish between an attribute and metadata. **[5]**

(b) The First National Bank of South Africa operates different types of accounts, savings, call and current accounts. All the accounts are identified by an account number but the savings is also identified by an interest rate; the call identified by savings period and special rate; the current is also identified by charges and cheque fees. All customers, who open accounts, are identified by their names, date of births, address, and their personal national id numbers.

(i) Draw an ER diagram for this database emphasizing the similarities between the different accounts the bank offers. **[8]**
(ii) Break down the ER diagram into tables. **[7]**

Question 4

(a) Why is an ER diagram desirable? **[5]**

(b) Draw an ER diagram to represent the database of a bookshop. This bookshop organizes information about publishers, authors and books. Each book has a code that uniquely identifies the book. In addition, the title, publisher, type of book, price and whether book is paperback or not is recorded. The author or authors of each book is recorded alongside the number of units the book are in stock in each of the branches of the bookstores. If a book is not available in one branch the database should be used to determine if any of the other branches currently have it in stock. Each branch is identified by name, number, location and number of employees. Publishers are identified by a publisher code, name and city where the publisher is located. The authors involved in the books sold are identified by name and number. **[15]**

Question 5

a) Discuss the advantages and disadvantages of a network model over a relational model, emphasizing when you would prefer to use it over the relational model. **[10]**

b) Distinguish between the hierarchical model and the network model, and how would you implement the hierarchal structure on a database that is not a tree. **[3+7]**

Question 6

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 **algebraic queries** for the database schema.

a) Retrieve the names of all employees in department 5 who work more than 10 hours per week on ProductX project. **[2]**
b) List the names of all employees who have a dependant with the same name as themselves. **[2]**
c) Find the names of all employees who are directly supervised by Franklin Wong. **[2]**
d) For each project, list the project name and total hours per week (by all employees) spent on that project. **[2]**
e) Retrieve all the names of employees who work on any project. **[2]**

Specify the following **SQL queries** for the database schema.

f) Retrieve names of all employees who do not work on any project. **[2]**
g) For each department retrieve the department name and the average salary of all employees working in that department. **[2]**
h) Retrieve the average salary of all female employees. **[2]**
i) Find the names and addresses of all employees who work on at least one project located in Houston but whose department has no location in Houston. **[2]**
j) List the last names of all department managers who have no dependents. **[2]**