



THE COPPERBELT UNIVERSITY
SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY

JULY/AUGUST, 2018 – SESSIONAL EXAMINATIONS
CS235 – DATABASE TECHNOLOGY

TIME ALLOWED: THREE HOURS

INSTRUCTIONS :

- **Maximum Marks Available – 100**
- **This paper has SIX(6) Questions**
- **Answer Question One (1), it is Mandatory and**
- **Answer Any FOUR(4) from the remaining FIVE(5) Questions**
- **All Questions Carry Equal Marks (20 marks)**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

QUESTION ONE (Mandatory Question)

LeChaamwe Enterprises is a company that specializes in farming activities and wishes to develop a database system for its operations. The company wishes to keep records of its employees of which each employee is identified by NRC, Name, Phone number, Age, Gender and Marital status. The company runs a number of farming projects and each project is identified by Project Id and Project Name. An employee can work on one or more projects and each project can have many employees working on it. The company has a number of farms and each farm is identified by Farm Id and Farm name. Each employee works at a particular farm. Each farm has a manager managing it. Each farm comes up with its own project/s and controls that project/s. Apart from farms, the company also owns a number of property such as tractors and each property is identified by Property Id and Property Name. Employees may use the property for their projects.

- a) Draw an ER diagram for the above requirement specification **[12 marks]**
- b) Convert the ERD you have drawn into relational schemas. **[8 Marks]**

NB: Show all the necessary steps for both QUESTION ONE a) and b)

QUESTION TWO

- a) State and briefly discuss four (4) ADVANTAGES of Database systems. **[6 marks]**
- b) Define the following database terminologies. **[4 marks]**
 - i) Logical data independence
 - ii) Database
 - iii) Relational database Schema
 - iv) Candidate key
- c) State and briefly discuss four (4) disadvantages of File Based Systems. **[4 marks]**
- d) State and briefly discuss four (4) functions of a DBMS. **[6 marks]**

QUESTION THREE

- a) During the database system development information is analyzed to identify requirements for new database system. An important activity involves deciding how to manage the database system with multiple user views. Three main approaches can be used. Discuss briefly these approaches. **[6 marks]**

- b) State and briefly discuss the first four (4) phases of a database system development lifecycle. **[6 marks]**
- a) State and briefly discuss the four (4) guidelines for relational database schema design. **[8 marks]**

QUESTION FOUR

- a) Define a functional dependency comprehensively and the three types of functional dependencies. **[6 marks]**
- b) Given the relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional dependencies. Determine the candidate key of R and hence or otherwise Decompose R into 2NF, then 3NF relations. **[8 marks]**

- $A \rightarrow D, E$
 $B \rightarrow F$
 $D \rightarrow I, J$
 $F \rightarrow G, H$
 $A, B \rightarrow C$

- c) When is a table said to be in Boyce Codd Normal Form (BCNF) and hence or otherwise normalize the table below to BCNF. **[6 marks]**

Student	subject	Lecturer
1122679	Web Design	Mr Shumba
1122679	Computer Networks	Mr Lengwe
1023456	Web Design	Mr Shumba
1045678	Internet Tech	Dr Libati
1167859	Web Design	Mr Nkandu

QUESTION FIVE

- a) State the steps of normalizing tables into the following normal forms. **[8 marks]**
- i) 1st normal, ii) 2nd Normal, iii) 3rd Normal and iv) Boyce code Normal forms
- b) The Functional Dependencies below are identified between various attributes of Parts in a company warehouse:

FD1: Part No -----> Part Description

FD2: Pack Size, Part No -----> Price

FD3: Pack Size, Part No -----> Floor No

FD4: Floor No -----> Storage Location

Produce the Relational Schema in the Second Normal Form and then in the Third Normal Form and Boyce Codd normal forms. **[6 marks]**

- c) Use an example to define a functional dependency and hence or otherwise state four (4) purposes of normalization. **[6 Marks]**

QUESTION SIX

- a) State and discuss the integrity constraints applied on relational databases and hence or otherwise state briefly how SQL can allow implementation of the entity integrity and referential integrity constraints. **[6 marks]**
- b) State and briefly discuss the three parameters used to measure correctness of fragmentation in distributed databases. **[6 marks]**
- c) Consider the following relational schema:

employee (ssn, name, gender, address, salary, supervisorSSN, dnumber)

department (dnumber, dname, managerSSN)

deptLocation (dnumber, dlocation)

project (pnumber, pname, plocation)

worksOn (emplSSN, pnumber, hours)

Answer these queries using both relational algebra and SQL statements: **[8 marks]**

- i). Find each employee's Ssn who does not work on any project.
- ii). Find each department (dname) who has employees working on projects at locations other than a department's location (i.e. plocation \neq dlocation)
- iii). Find the number of employees working on projects located in Kitwe.
- iv). Find the number of employees and the total salary for employees in each department