



THE COPPERBELT UNIVERSITY
SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY
IT/IS DEPARTMENT

MAY, 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**

QUESTION ONE (Mandatory Question)

The Copperbelt University keeps track of each student's name, student number, NRC#, address, phone, birth date and sex. A student enrolls into a programme. A programme has name and code. A programme is offered by a department and a department can offer a number of programs. A programme is made up of courses and a course is identified by course number and course name. A student takes a number of courses and a course can be taken by many students. The university also keeps track of each Lecturer's name, Man number, phone and address. A Lecturer belongs to a department and lectures at least one course. A department belongs to a School and each school is identified by Name. A School is headed by a dean. Final year students are expected to do projects before they can graduate; a project is identified by Name and number. Lecturers supervise these projects.

a) Draw an ER diagram for the above requirement specification **[10 marks]**

b) Convert the ERD you have drawn into relational schemas. **[10 Marks]**

NB: Show all the necessary steps for both Q 1 a) and b)

QUESTION TWO

a) Briefly discuss four (4) objectives of the three level database architecture. **[6 marks]**

b) Discuss the following advantages of Database Systems. **[8 marks]**

i) Improved data integrity ii) Enforcement of standards

iii) Improved data accessibility and responsiveness iv) Economy of scale

c) Discuss the following disadvantages of Database Systems. **[6 marks]**

i) Additional hardware costs ii) Cost of conversion

iii) Performance iv) Higher impact of a failure

QUESTION THREE

a) Database planning is the first stage in the Database System Development lifecycle; it may also include development of standards. State at least four things that these standards would govern: **[4 marks]**

- b) Define File based Systems and hence or otherwise state six (6) limitations of these systems. **[8 marks]**
- c) State and briefly discuss the four (4) guidelines for relational database schema design. **[8 marks]**

QUESTION FOUR

- a) A relation is a table with columns and rows; it only applies to logical structure of the database, not the physical structure. What does the later part of the statement mean **[4 marks]**
- b) Define a functional dependency comprehensively and the three types of functional dependencies. **[6 marks]**
- c) Given the relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional dependencies:

$$\begin{aligned} A &\longrightarrow D, E \\ B &\longrightarrow F \\ D &\longrightarrow I, J \\ F &\longrightarrow G, H \\ A, B &\longrightarrow C \end{aligned}$$

- i) Determine the candidate key of R **[2 marks]**
- ii) Decompose R into 2NF, then 3NF relations. **[8 marks]**

QUESTION FIVE

- a) What do the following relational algebra operations do on a table(s). **[6 marks]**
- i) Select ii) Project iii) Cartesian Product iv) Difference
- b) Briefly describe the six clauses in the syntax of an SQL query, and show which of the six clauses are required and which are optional. **[6 marks]**
- c) 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. **[8 marks]**

QUESTION SIX

- a) Consider the LIBRARY relational database schema shown in the given Figure on page 5 and write down SQL statements for the following queries. **[12 marks]**
- i) Find all the details of the publisher that published a book authored by Mr Mulenga.
 - ii) Find the number of books borrowed by Chanda Mulenga from the CBU Library.
 - iii) Find the details for each author that has contributed more than 2 different books at the CBU library.
 - iv) Find the number of copies of the book titled “*Internet Technologies*” owned by each library branch.
- b) When is a table said to be in second normal form (2NF) and Third normal form (3NF) respectively and given a relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional Dependencies. $F = \{\{A, B\} \rightarrow \{C\}, \{A\} \rightarrow \{D, E\}, \{B\} \rightarrow \{F\}, \{F\} \rightarrow \{G, H\}, \{D\} \rightarrow \{I, J\}\}$, Determine the key for R and hence or otherwise decompose R into 2NF and then 3NF relations. **[8 marks]**

LIBRARY relational database schema

