



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS**

**DEPARTMENT OF COMPUTER SCIENCE AND SOFTWARE  
ENGINEERING**

**UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR SCIENCE IN  
COMPUTER SECURITY AND FORENSICS**

**2<sup>ND</sup> YEAR 1<sup>ST</sup> SEMESTER 2018/2019 ACADEMIC YEAR**

**MAIN CAMPUS**

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**COURSE CODE: IIT 3213**

**COURSE TITLE: DATABASE ADMINISTRATION AND DESIGN**

**EXAM VENUE: STREAM: BSC COMP. SECURITY**

**DATE: DECEMBER 2018 EXAM SESSION:**

**TIME: 2.00 HOURS**

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**INSTRUCTIONS:**

- 1. Answer Question 1 (Compulsory) and ANY other two questions**
- 2. Candidates are advised not to write on the question paper**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room**

## QUESTION ONE

[30 MARKS]

- (a) Define the following terms and concepts as applies to Database Design and Administration. [8 Marks]
- |                            |                               |
|----------------------------|-------------------------------|
| (i) Database Schema        | (iii) Recursive Relationships |
| (ii) Data Control Language | (iv) Denormalization          |
- (b) Give any **three** benefits of using a database management system to store and access data over using a file system. [3 Marks]
- (c) Database systems have several kinds of independence and are organized into layers. In particular the physical, logical, and conceptual layers are independent, and the software of a database system is independent of the kind of data to be stored. Explain why such independence is desirable, and whether independence have any advantages. [4 Marks]
- (d) Give any two main objectives to consider while designing a secure database application. [2 Marks]
- (e) “Learning Structured Query Language (SQL) is a major part of database course but knowledge about relational algebra and relational calculus is also very important”. Do you agree with the statement? Explain your answer. [2 Marks]
- (f) Consider a set of functional dependencies for a relation  $R(A,B,C,D,E,F)$ ,  $F = \{AB \rightarrow C, DC \rightarrow AE, E \rightarrow F\}$ . Is the decomposition  $(A,B,C,D) (B,C,D,E,F)$  a dependency preserving decomposition? If not, briefly explain. [3 Marks]
- (g) “There are four important properties of transactions that a Database Management System (DBMS) must ensure to maintain data in the face of concurrent access and system failure”. Discuss. [8 Marks]

## QUESTION TWO

[20 MARKS]

- (a) Explain any two advantages and any two disadvantages of the following database models below. [8 Marks]
- |                                     |
|-------------------------------------|
| (i) Hierarchical Database Model     |
| (ii) Object-Oriented Database Model |
- (b) “The Database Management Systems (DBMS) can be classified according to the number users, the database site location(s), and the expected type and extended use”. Do you agree with this statement? Explain. [4 Marks]

(c) Consider the following relational database schema:

Employee (employee\_id, name, hire\_date, pos\_title\*, salary, dept\_name\*)

Position (pos\_title, level)

Department (dept\_name, location, phone)

Primary keys are underlined and foreign keys are denoted by \*. Each position has a level and the attribute **hire\_date** uses integers to represent dates.

Express the following query in SQL, Relational Algebra and Relational Calculus.

[8 Marks]

*List employees that are of manager level and earns at least KES 120,000.*

### QUESTION THREE

[20 MARKS]

Consider a description for a physical therapy center database below.

A database is needed to keep track of the operation of a physical therapy center. Every patient must be referred by a physician and have a prescription for physical therapy in order to receive treatments. A patient may have different physicians at different times. The database keeps all information about the prescriptions and treatments, both past and current. When appointments are made, the information about scheduled date and time is recorded. No patient is ever scheduled for two visits on one day. The center has several physical therapists, and a patient may be treated by different physical therapist at different visits. When a patient makes a visit at an appointed time, the name of the therapist, the treatment, the date, time, and the equipment used are all recorded for that visit. Each of these has only one value for the visit. This information will be used later for insurance billing, which is not part of the database.

(a) Draw an ER diagram for the physical therapy center database as described above. In your ER diagram, you must properly denote all applicable concepts, including weak or strong entities, and keys, composite or multi-valued attributes; relationships and their cardinality and participation constraints.

[8 Marks]

(b) Map the ER diagram developed in (a) above to a set of relations. For each relation, list the functional dependencies. Also for each relation, underline primary keys and asterisk any foreign keys, and give its normal form.

[12 Marks]

#### QUESTION FOUR

[20 MARKS]

- (a) “The Database Administrator (DBA) must be cognizant of the features of the database management systems (DBMS) in order to apply the proper techniques for optimizing the performance of the database structures”. Explain in support of this statement. [6 Marks]
- (b) “The various types of constraints that are placed on a database contribute to the degree of reliability, consistency and accuracy of the data that is stored in the database. These constraints help to ensure that the data is sensible”. Discuss. [8 Marks]
- (c) Consider the relational schema given below:  
**PART (PARTNO, PARTDESCR, SUPPLIERN, SUPPLIERNAME, PRICE, DATE, QTY)**  
State any reasonable assumptions or rules, give the functional dependencies based on your assumptions and transform the relation above into 3NF or BCNF. [6 Marks]

#### QUESTION FIVE

[20 MARKS]

- (a) Distinguish between *conflict serializability* and *view serializability* as applies to concurrency control in distributed database system. [4 Marks]
- (b) Explain an SQL query block in the context of query optimization. [2 Marks]
- (c) Explain any two types of: [8 Marks]
- (i) Privileges commonly provided by modern DBMS
  - (ii) Image copy back-ups as applies in database backups
  - (iii) Metadata at the fundamental level.
  - (iv) Perspectives of viewing data warehouse performance.
- (d) Use a suitable example to demonstrate how a **database view** can be defined from an existing base table. Comment on the suitability of using views in enhancing row and column level security to a database system. [6 Marks]

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