(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE

OF

BACHELOR OF SCIENCE OF COMPUTER SCIENCE

COURSE CODE: BCS 221

COURSE TITLE: DATABASE SYSTEMS I

DATE: Wednesday 20/04/2022 **TIME:** 8:00a.m-10:00a.m

INSTRUCTIONS TO CANDIDATES

Question ONE (1) is compulsory
Attempt any TWO (2) questions

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

QUESTION ONE [30 MARKS]

a) List at least four responsibilities of a database management system. For each responsibility, explain the problems that would arise if the responsibility were not discharged, If these responsibilities were not met by a given DBM, the following problems can Occur? **[8 Marks]**

b) Explain the difference between a weak and a strong entity set. **[4 Marks]**

c) We can convert any weak entity set to a strong entity set by simply adding appropriate attributes. Why, then, do we have weak entity sets? **[6 Marks]**

d) Describe what you understand by the term 'Relational Model' and identify the main components of relational Model **[6 Marks]**

e) With examples discuss what you understand by cardinality in database system? **[6 Marks]**

QUESTION TWO [20 Marks]

A university wants to use a database to store information about its departments, divisions and employees. Each department at the university has a unique name. Each department contains several divisions. Divisions in different departments can have the same name, but the division names within each department are unique. There can be many employees in each division, but each employee is employed at only one division. For each employee, their name and their unique personNumber should be stored. There are two kinds of employee at the university: faculty members and PhD students. For each PhD student, one faculty member is appointed to be their examiner. Each PhD student also has one main supervisor, but they can have zero or more co-supervisors. One faculty member at each department is appointed to be the head of that department. Similarly, one faculty member at each division is appointed to be the head of that division.

i. Draw an E-R diagram that correctly models this domain. **[10 Marks]**

ii. Translate this E-R diagram into a set of relations, clearly marking all references and keys. **[10 Marks]**

QUESTION THREE [20 Marks]

The following database contains information about actors, plays, and roles performed.
Actor(actor_id, name, year_born)
Play(play_id, title, author, year_written)
Role(actor_id, character_name, play_id)

Where:

Actor is a table of actors, their names, and the year they were born. Each actor has a unique actor_id, which is a key.
Play is a table of plays, giving the title, author, and year written for each play. Each play has a unique play_id, which is a key.

Role records which actors have performed which roles (characters) in which plays. Attributes actor_id and play_id are foreign keys to Actor and Play respectively. All three attributes make up the key since it is possible for a single actor to play more than one character in the same play.

i. Write the SQL statements that define the relational schema (tables) for this database. Assume that actor_id, play_id, year_born, and year_written are all integers, and that name, title, author, and character_name are strings. *Be sure to define appropriate keys and foreign key constraints.*
[10 Marks]

ii. Write a SQL query that returns the number of actors who have performed in three or more different plays written by the author "Faith Peter"
[10 Marks]

QUESTION FOUR

a) Describe the ANSI/SPARC three level architecture for database management systems software and explain the advantages it provides.
[8 Marks]

b) How are database structures at each of the three levels specified in most database management systems?
[6 Marks]

c) SQL by default does not remove duplicate rows. Discuss the main reason for this approach and illustrate your answer with an SQL query.
[6 Marks]

QUESTION FIVE [20 Marks]

Use the following

A(<u>a1</u> <u>a2</u> a3, a4)

B(<u>b1</u> (<u>b2</u>, b3))

C(<u>c1</u>, c2, c3, c4)

Dependencies:

a2 → a4

c3 ↛ c4

a) In what normal form are the above relational schemes, given the associated dependencies? Transform these relations to third normal form, showing the steps involved. [12 Marks]

b) Discuss briefly the purpose of normalisation, detailing also its disadvantages. [8 Marks]