MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR
SECOND YEAR FIRST SEMESTER

SCHOOL OF SCIENCE
BACHELOR OF SCIENCE IN INFORMATION SCIENCE

COURSE CODE: INS 2204

COURSE TITLE: DATABASE SYSTEMS

DATE: 24TH APRIL 2018 **TIME: 0830 - 1030HRS**

INSTRUCTIONS TO CANDIDATES

Answer Question **ONE** and any other TWO questions

*This paper consists of **6** printed pages. Please turn over.*

SECTION A (30Marks): Answer all questions from this section

QUESTION 1

(a) Define the following **(6 Marks)**

(i) Relationships

(ii) Constraints

(iii) Scheme

(b) Explain the difference between the following **(4 Marks)**

(i) Superkey and Candidate Key

(ii) Strong Entity and Weak Entity Sets

(c) Compare and contrast TRUNCATE and DELETE for a table **(2 Marks)**

(d) Explain the statement that relational algebra operators can be composed **(3 Marks)**

(e) A table is classified as a parent table and you want to drop and re-create it. How would you do this without affecting the children tables. **(2 Marks)**

(f) What is relational completeness **(2 Marks)**

(g) Given two relations R1 andR2, where R1 contains N1 tuples, R2 contains N2 tuples, and N2 > N1 > 0, give the minimum and maximum possible sizes (in tuples) for the resulting relation produced by each of the following relational algebra expressions. In each case, state any assumptions about the schemas for R1 andR2 needed to make the expression meaningful **(4 Marks)**

(a) $R1 \cup R2$

(b) $R1 \cap R2$

(c) $R1 - R2$

(d) $R1 \times R2$

(h) How do you maintain database integrity where deletions from one table will automatically cause deletions in another table? **(3 Marks)**

(i) SQL functions fit into two broad categories, list and explain them **(4 Marks)**

SECTION B (40Marks): Answer TWO questions from this section

QUESTION 2

(a) Notown Records has decided to store information about musicians who perform on its albums (as well as other company data) in a database. The company has wisely chosen to hire you as a database designer (at your usual consulting fee of Kshs. 25000/day).

- Each musician that records at Notown has an SSN, a name, an address, and a phone number. Poorly paid musicians often share the same address, and no address has more than one phone.
- Each instrument used in songs recorded at Notown has a unique identification number, a name (e.g., guitar, synthesizer, flute) and a musical key (e.g., C, B-flat, E-flat).
- Each album recorded on the Notown label has a unique identification number, a title, a copyright date, a format (e.g., CD or MC), and an album identifier.
- Each song recorded at Notown has a title and an author.
- Each musician may play several instruments, and a given instrument may be played by several musicians.
- Each album has a number of songs on it, but no song may appear on more than one album.
- Each song is performed by one or more musicians, and a musician may perform a number of songs.
- Each album has exactly one musician who acts as its producer. A musician may produce several albums, of course.

Design a conceptual schema for Notown and draw an ER diagram for your schema. The preceding information describes the situation that the Notown database must model. Be sure to indicate all key and cardinality constraints and any assumptions you make. Identify any constraints you are unable to capture in the ER diagram and briefly explain why you could not express them. **(10 Marks)**

(b) Discuss the important role played by users in the process of database design. **(5 Marks)**

(c) Consider the following relations:

Student(snum: integer, sname: string, major: string, level: string, age: integer)
Class(name: string, meets at: time, room: string, fid: integer)
Enrolled(snum: integer, cname: string)
Faculty(fid: integer, fname: string, deptid: integer)

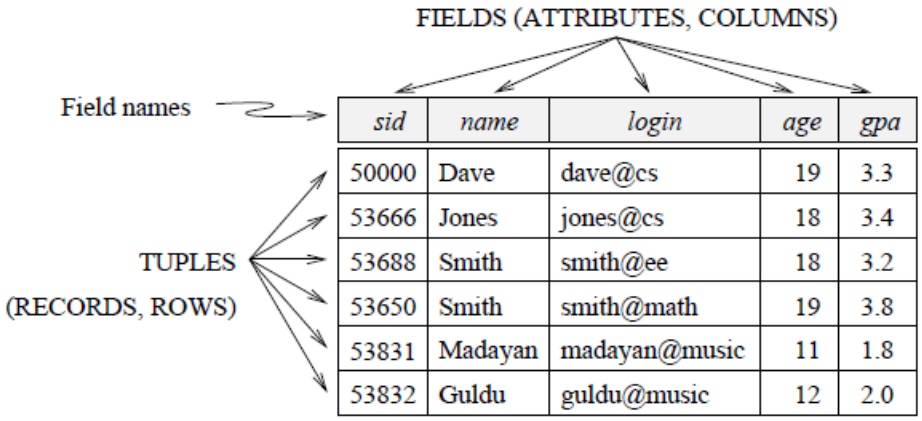
The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class.

Write the SQL statements required to create these relations, including appropriate versions of all primary and foreign key integrity constraints.
(5 Marks)

QUESTION 3

(a) What is the difference between inner and outer join? **(2 Marks)**

(b) Consider the instance of the Students relation shown below **(6 Marks)**



sid	*name*	*login*	*age*	*gpa*
50000	Dave	dave@cs	19	3.3
53666	Jones	jones@cs	18	3.4
53688	Smith	smith@ee	18	3.2
53650	Smith	smith@math	19	3.8
53831	Madayan	madayan@music	11	1.8
53832	Guldu	guldu@music	12	2.0

(i) Give an example of an attribute (or set of attributes) that you can deduce is not a candidate key, based on this instance being legal.

(ii) Is there any example of an attribute (or set of attributes) that you can deduce is a candidate key, based on this instance being legal?

(c) Discuss the main types of threat that could affect a database system, and for each, describe the possible outcomes for an organization.
(6 Marks)

(d) A university database contains information about professors (identified by social security number, or SSN) and courses (identified by courseid). Professors teach courses; each of the following situations concerns the Teaches relationship set.
For each situation, draw an ER diagram that describes it (assuming no further constraints hold). **(6 Marks)**

(i) Professors can teach the same course in several semesters, and each offering must be recorded.

(ii) Professors can teach the same course in several semesters, and only the most recent such offering needs to be recorded. (Assume this condition applies in all subsequent questions.)

(iii) Every professor must teach some course.

(iv) Every professor teaches exactly one course (no more, no less).

(v) Every professor teaches exactly one course (no more, no less), and every course must be taught by some professor.

(vi) Now suppose that certain courses can be taught by a team of professors jointly, but it is possible that no one professor in a

team can teach the course. Model this situation, introducing additional entity sets and relationship sets if necessary.

QUESTION 4

(a) The Prescriptions-R-X chain of pharmacies has offered to give you a free lifetime supply of medicine if you design its database. Given the rising cost of health care, you agree. Here's the information that you gather:

- Patients are identified by an SSN, and their names, addresses, and ages must be recorded.
- Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded.
- Each pharmaceutical company is identified by name and has a phone number.
- For each drug, the trade name and formula must be recorded. Each drug is sold by a given pharmaceutical company, and the trade name identifies a drug uniquely from among the products of that company. If a pharmaceutical company is deleted, you need not keep track of its products any longer.
- Each pharmacy has a name, address, and phone number.
- Every patient has a primary physician. Every doctor has at least one patient.
- Each pharmacy sells several drugs and has a price for each. A drug could be sold at several pharmacies, and the price could vary from one pharmacy to another.
- Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs for several patients, and a patient could obtain prescriptions from several doctors. Each prescription has a date and a quantity associated with it. You can assume that, if a doctor prescribes the same drug for the same patient more than once, only the last such prescription needs to be stored.
- Pharmaceutical companies have long-term contracts with pharmacies. A pharmaceutical company can contract with several pharmacies, and a pharmacy can contract with several pharmaceutical companies. For each contract, you have to store a start date, an end date, and the text of the contract.
- Pharmacies appoint a supervisor for each contract. There must always be a supervisor for each contract, but the contract supervisor can change over the lifetime of the contract.

Draw an ER diagram that captures the preceding information. Identify any constraints not captured by the ER diagram. **(9 Marks)**

(b) The following table shows an extract from the records of a food shop. It shows CUSTOMERs and the PRODUCTSs that they purchased.

(6 Marks)

CUSTOMER	PRODUCT
Jones	Eggs
Smith	Eggs
Lewis	Apples
Lewis	Butter
Khan	Butter

Draw an ERD diagram showing

a) How each occurrence of customer of CUSTOMER is related to occurrence(s) of PRODUCT
b) How each occurrence of customer of PRODUCT is related to occurrence(s) of CUSTOMER

(c) Consider the following schema:

Suppliers(sid: integer, sname: string, address: string)
Parts(pid: integer, pname: string, color: string)
Catalog(sid: integer, pid: integer, cost: real)

The key fields are underlined, and the domain of each field is listed after the field name. Therefore sid is the key for Suppliers, pid is the key for Parts, and sid and pid together form the key for Catalog. The Catalog relation lists the prices charged for parts by Suppliers. Write the following queries in SQL.

(5 Marks)

(i) Find the sids of suppliers who supply some red part and some green part.
(ii) Find the sids of suppliers who supply every part.
(iii) Find the sids of suppliers who supply every red part.
(iv) Find the sids of suppliers who supply every red or green part.
(v) Find the sids of suppliers who supply every red part or supply every green part.

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