MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2017/2018

SECOND YEAR FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

MAIN CAMPUS

CIT 215/CCT 211: DATABASE SYSTEMS

Date: 16th February, 2018 Time: 12.00 - 3.00 pm

INSTRUCTIONS:

- Answer ALL questions in SECTION A and any other TWO from SECTION B
- Write your registration number on all sheets of the answer book used.
- Use a NEW PAGE FOR EVERY QUESTION attempted, and indicate number on the space provided on the page of the answer sheet.
- Fasten together all loose answer sheets used.
- Mobile phones and PDAs are NOT allowed in the examination room.

SECTION A

ATTEMPT ALL QUESTIONS IN THIS SECTION

(a) Explain what is meant by a transaction and why it is an important unit of operation in a DBMS? (3 marks)

(b) With reference to a sample relation of your own choosing, explain and discuss the following relational model terminology, including its function and any related concepts. A good diagram showing your sample relation is strongly suggested.

- Tuple
- Attribute
- Domain
- Degree
- Cardinality

Each item is equally weighted. (10 marks)

(c) Differentiate between a weak entity and a strong entity (2 marks)

(d) Study the tables below: Children, Playgroups, Activities. The Children tables contains data about children (names, ages and addresses of parents) - we assume for simplicity that names are unique, Playgroups says which child is in which playgroup and Activities says what children in the playgroup did on a certain date (for example, went to a zoo).

Children		
Name	Age	Address

Playgroups	
PlaygroupID	Name

Activities		
PlaygroupID	ADate	Description

Write SQL queries to do the following:

i. Find a list of names of all children. (1 marks)

ii. Find a list of names of all children aged 4. (1 mark)

iii. Return a list of names and addresses of all children in the playgroup with PlaygroupID equal to 1. (1 mark)

iv. Find a list of names and ages of children in a playgroup which went to the zoo on the 21st of February 2009 (check for Activities.Description value Zoo). (5 marks)

v. Return a list of playgroup IDs and average age of children for each playgroup. (5 marks)

vi. Add an extra column to the Activities table which is called Supervisor and has the type of values VARCHAR(20). (2 marks)

SECTION B

ATTEMPT ANY TWO QUESTIONS IN THIS SECTION

QUESTION 2

You are asked to design a database for the following scenario. A research laboratory is running several drug trials on healthy volunteers to check whether drugs have side effects. Each drug has a unique name. Each trial involves exactly one drug and several volunteers (who take the drug and report if they had any side effects). For each volunteer in each trial it needs to be recorded whether the volunteer had any side effects, and if yes, what those side effects were (there could be several side effects experienced by the same person, for example headache, dry mouth, and fever). It is important that side-effects are described using some standard terminology, so that the laboratory can report what proportion of volunteers had the same side effect. For example, the researchers may tell you that headache should always be recorded as 'headache' and not sometimes as 'pain in the head' and sometimes as 'sore head'. There is however no fixed pre-defined set of possible side effects, because new effects can always be discovered (for example the drug may turn people a bright green colour). For simplicity, assume that each volunteer takes part in at most one drug trial. Data stored about volunteers is their National Insurance number, name, age, gender, address and telephone number.

(a) Draw an entity-relationship diagram for the drug trial scenario. (10 marks)

(b) Write SQL statements to create the tables (don't forget to specify primary and foreign keys). (10 marks)

(c) Explain what is referential integrity, and explain it on the example of foreign keys in your answer to question (b). (5 marks)

QUESTION 3

Using the following sample relation and your knowledge of declarative constraints:

STUDENT (Title, Name, Gender, Birthday, Address, Email, Mobile, SID, MID, PROJID, PLACID)

- SID is the student identifier
- MID is the identifier of the compulsory assigned staff mentor
- PROJID is the identifier of the optional project selected by the student
- PLACID is the identifier of the optional industrial placement undertaken by the student

Address each of the following tasks.

a) Suggest and justify a PRIMARY KEY for this relation. Write the correct SQL code to implement this. (4 marks)

b) Suggest and justify any FOREIGN KEYS for this relation. Write the correct SQL code to implement this. (4 marks)

c) Suggest and justify all CANDIDATE KEYS for this relation. Write the correct SQL code to implement this. (4 marks)

d) Suggest and justify one DOMAIN constraint that enforces the entering of a value in a column. Write the correct SQL code to implement this. (4 marks)

e) Suggest and justify one DOMAIN constraint that verifies the entered value in a column. Write the correct SQL code to implement this. (4 marks)

QUESTION 4

a) If an attribute is a primary (or part of a primary) key, why can it not be null? (3 marks)
b) Give a definition for the concept of a candidate key. (5 marks)
c) What is meant by the term data redundancy? (3 marks)
d) During physical design of a database environment, what advantage does RAID 5 have over RAID 1? Over RAID 0? Disadvantages? (3 marks)
e) While tuning your database, explain the rationale for the following:

i. Avoiding using the logical operator OR in a query if possible. (2 marks)

ii. Avoiding number-to-character conversions. (2 marks)

QUESTION 5

a) You are designing a database for KW Humane Society. The result is the following set of relations where the type of each relations attribute is given following the attribute (e.g., ID: integer):

Animals(<u>ID: integer</u>, Name: string, PrevOwner: string, DateAdmitted: date, Type: string)
Adopter(<u>SIN</u>: integer, Name: string, Address: string, OtherAnimals: integer)
Adoption(<u>AnimalID</u>: integer, SIN: integer, AdoptDate: date, chipNo: integer)

where

i. The primary keys are underlined.
ii. Animals stores information about the animals currently at the Humane Society. Each is given an ID, and their names together with the SIN of their previous owners (attribute PrevOwner), and their date of admission is recorded. Type refers to the type of animal (dog, cat, etc).

iii. Adopter is the relation that holds information about animal adopters. The attributes are self-descriptive, except OtherAnimals which records the number of other animals that the adopter currently has at home.

iv. AnimalID in Adoption refers to the ID of Animals. Similarly, SIN in Adoption refers to the SIN of Adopter. Attribute chipNo stores the number on the microchip that is implanted on the animal for tracking. Owner in Animals refers to the SIN of Adopter (in this case the previous adopter).

Formulate the following queries in SQL; each one is worth 2 points:

i. Retrieve the total number of dogs that were brought to the Humane Society on 18 April 2000. (2 Marks)

ii. List the name of the adopter who has adopted every type of animal. (2 Marks)

iii. For each animal type, list the animal type and total number of adoptions on 14 June 1999. (2 Marks)

iv. List the types of animals who have not had any adoptions. (2 Marks)

v. For each adopter who has made at least two adoptions, list their names and addresses. (2 Marks)

b) Suppose that the Authoring relation is created as follows:

CREATE TABLE Authoring(articleID INT REFERENCES Article(ID) ON DELETE SET NULL, authorID INT REFERENCES Author(ID) ON DELETE CASCADE)

Indicate which of the following statements are true, and which are not. Use the answer sheet of the exam for your answer.

1. If we try to delete a tuple from Authoring, the tuple is not deleted. Instead, articleID is set to NULL. (1 Mark)
2. If we delete a tuple from Authoring, any tuples in Author referred to by this tuple are also deleted. (1 Mark)
3. If we delete a tuple from Article, some attributes of Authoring may have their values set to NULL. (1 Mark)
4. If we try to insert a tuple into Author, with an ID that is not referred to in Authoring, the operation is rejected. (1 Mark)
5. If we try to insert a tuple into Authoring, with an ID that does not exist in Author, the operation is rejected. (1 Mark)

c) Write CHECK constraints for Articles of Problem 2 that ensure the following:

1. Values of the journal attribute does not start with 'Journal'. (2 Marks)

2. The value of the endpage attribute is never smaller than that of startpage. (2 Marks)

3. The value of year is given in full (e.g. 1999 is not abbreviated as 99). You may assume that year is of type integer, and that there are no articles more than 200 years old. (1 Marks)