University of Jaffna, Sri Lanka

Bachelor of Science Degree Examination in Computer Science - Level 2S - 2018

(End of Course Examination)

Computer Science

CSC201S2: Database Systems Concepts and Design

- Answer **Question 1 and Any Two of the Other Three**. (This paper has 4 questions on 4 pages.)
- At the bottom of the front page of your answer book, write the question numbers in the order you answered.
- Time allowed: **Two Hours**.

1. Database management system is important because it manages data efficiently and allows users to perform multiple tasks with ease.

   (a) Define what is meant by `Database Management System (DBMS)` and list three advantages and disadvantages of using DBMS. [04%]

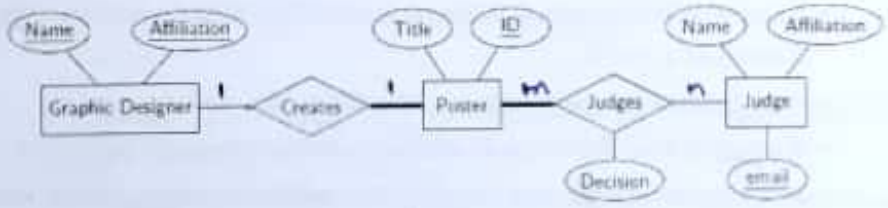
   (b) List the responsibilities of a Database Administrator (DBA). [02%]

   (c) Define the term `entity type` and state the differences between a `strong entity type` and a `weak entity type`. [05%]

   (d) Briefly describe the `Hierarchical` and `Network data models` with the aid of suitable examples. [04%]

   (e) i. Describe briefly how a simple ER model can be converted into a relational model. [04%]

   ii. Consider the following ER diagram. Assume that, *each poster is created by only one designer and judged by three different judges.* Map the given ER model to a relational model. Justify your answer. [08%]



   (f) List three types of anomalies that can occur in a unnormalised relation and briefly describe each of them aided with suitable examples. [06%]

   (g) Consider the following relation:

   `Book (book_title, authorname, book_type, listprice, author_affiliation, publisher)`

   Suppose the following functional dependencies exist:

   $book\_title \rightarrow publisher, book\_type$

   $book\_type \rightarrow listprice$

   $authorname \rightarrow author\_affiliation$

[Question 1 continues ...]

i. Identify in which normal form it is in and justify your answer. [08%]

(h) i. Define what is meant by the term `transaction` in the context of DBMS and briefly describe the properties of transaction. [05%]

ii. State three problems that would arise when transactions are executed concurrently without any concurrency control measures. [02%]

iii. State clearly the `Commit` and `Rollback` operations in a DBMS transactions. [02%]

[50% marks]

2. An entity relationship diagram (ERD) shows the relationships of entity sets stored in a database.

(a) Define the following participation constraints in an E-R model.

i. `Toal participation`

ii. `Partial participation` [04%]

(b) Describe the following kinds of relations using suitable examples:

i. `One-to-one relation`

ii. `One-to-many relation`

iii. `Many-to-many relation` [06%]

(c) Consider the following scenario:

- There are television series, which has a name, network and production company. and are identified by their name and network.
- A television series has one or more episodes, identified by episode number. Episodes also have a title and a length. No episode can exist without a corresponding television series.
- There are also movies. A movie is identified by its name and the year it was released. It also has a studio.
- An actor has unique number, name, birth date, and nationality.
- A writer is also identified by unique number, name and birth date
- An actor can appear as a "regular" on a television series, a guest star on an episode, and a performer in a movie.
- Each episode has one writer, and a movie has a writer.

i. Identify possible entities from the above description and draw an ER diagram for the above mentioned scenario. State any assumptions that were made. [15%]

[25% marks]

3. (a) Define the terms:

i. Data Definition Language

ii. Data Manipulation Language. [03%]

(b) State the differences between relational algebra and tuple relational calculus. [02%]

[Question 3 continues ...]

(c) Consider the following relations:

- `Doctor(SSN, FirstName, LastName, Specialty, YearsOfExperience, PhoneNum)`
- `Patient(SSN, FirstName, LastName, Address, DOB, PrimaryDoctor_SSN)`
- `Medicine(TradeName, UnitPrice, GenericFlag)`
- `Prescription(Id, Date, Doctor_SSN, Patient_SSN)`
- `Prescription_Medicine(Prescription Id, TradeName, NumOfUnits)`

1. The Doctor relation has attributes Social Security Number (SSN), first and last names, specialty, the number of years of experience, and the phone number.
2. The Patient relation has attributes SSN, first and last names, address, date of birth (DOB), and the SSN of the patient's primary doctor.
3. The Medicine relation has attributes trade name, unit price, and whether or not the medicine is generic (True or False).
4. The Prescription relation has attributes the prescription id, the date in which the prescription is written, the SSN of the doctor who wrote the prescription, and the SSN of the patient to whom the prescription is written.
5. The Prescription_Medicine relation stores the medicines written in each prescription along with their quantities (number of units).

i. Write the relational algebra expressions for the following queries.

(α) List the trade name of generic medicine with unit price less than *50*.

(β) List the first and last name of patients whose primary doctor's name is *John Smith*.

(γ) List the first and last name of doctors who are not primary doctors to any patient.

(δ) For medicines written in more than *20* prescriptions, report the trade name and the total number of units prescribed.

(ϵ) List the SSN of patients who have *Aspirin* and *Vitamin* trade names in one of their prescription.

(ζ) List the SNN of distinct patients who have *Aspirin* prescribed to them by the doctor named *John Smith*.

(η) List the first and last name of patients who have no prescriptions written by doctors other than their primary doctor. [20%]

[25% marks]

Date: November 29, 2019

ORDER NO: 9163

Mr. Thomes
K.K.S Road,
Jaffna.

SHIPPING ADDRESS: Temple road
Nallur,
Jaffna.

PHONE: 0202215456

CUSTOMER DISCOUNT: 5%

ITEM #	PRODUCT CODE	DESCRIPTION	QTY	PRICE/UNIT	AMOUNT
1	FR223	HALF SIZE REFRIGERATOR	2	7500.00	15000.00
2	TB101	PATIO TABLE	3	4500.00	13500.00
3	CH089	PATIO CHAIRS	5	3500.00	17500.00
			TOTAL		9850.00
			DISCOUNT AMT		492.00
			AMOUNT OWING		9357.50

(a) Describe the meaning of each of the following terms with a suitable example:

i. Primary key

ii. Candidate key

iii. Foreign Key

iv. Alternate Key

(b) i. Define first, second and third normal forms. [04%]

ii. Consider a relation including all the details in the bill given above. Convert this relation into third normal form. State clearly any assumptions you make and showing all the intermediate steps. [06%]

[15%]

[25% marks]

End