University of Sri Jayewardenepura

B.Sc. (General) Degree Second Year

Second Semester Terminal Course Unit Examination – November 2016

CSC 209 2.0 Database Management Systems

(Time: 2 hours)

Answer all questions.

Question 1 (25 Marks)

(a) Database design involves number of phases that includes Requirements Collection and Analysis, Conceptual Design, Logical Design, and Physical Design. Briefly explain what activities are taking place in each of these phases.

(8 Marks)

(b) Define the terms attribute, attribute domain, tuple, relation schema and relational database instance used in relational data modeling.

(5 Marks)

(c) Constraints are conditions that must hold on all valid relation states. There are three main types of constraints in the relational model. Key constraints, Entity integrity constraints and Referential integrity constraints are among them. Briefly explain each of these constraints.

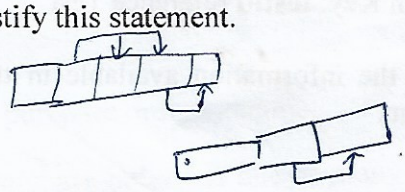
(6 Marks)

(d) Using an example, explain what is meant by "Deletion Anomaly".

(3 Marks)

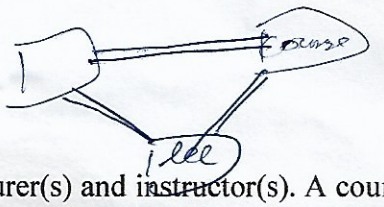
(e) "A relation, which is in 3 NF is not in BCNF". Justify this statement.

(3 Marks)



Question 2 (25 Marks)

(a) Consider the following segment of data requirements in a University database. There are lecturers who teach courses, instructors who assist in doing tutorials and practical, and projects under taken by lecturers. A lecturer can be employed as either professor, senior lecturer or probationary lecturer. Each lecturer has an id, name, gender, year of birth, salary, educational qualification(s). A professor has a rank (senior, full, associate), a senior lecturer has a grade (I, II) and probationary lecturer has a period. A course has a course code, title and credit value. A course can be either under graduate or post graduate. An undergraduate course can have a type (GPA or NGPA), while post graduate course has a level (MSc, MPhil, PhD). An instructor has an



id and name. Each course is assigned to lecturer(s) and instructor(s). A course is assigned to one or many lecturers and one or many instructors. An instructor is assigned for one or many courses and one or many lecturers. A lecturer can undertake zero or many research projects, for each project one or many lecturers can be involved. Each project has a title, grant name, duration and budget.

Using the modeling concepts used in Extended Entity Relationship (EER) modeling, draw an EER diagram to model these data requirements. State if any assumptions are used.

(15 Marks)

(b) Consider the following relational schema designed for a hospital Patient Management system.

Patient (**patient-id**, name, insurance, date-admitted, date-checked-out)
Primary key: **patient-id**

Doctor (**doctor-id,** name, specialization)
Primary key: **doctor-id**

Test (**testid**, testname, date, time, result)
Primary key: **testid**

Treatment (**patient-id, doctor-id**)
Primary key: **patient-id, doctor-id**
Foreign Key: **patient-id** reference Patient
Foreign Key: **doctor-id** reference Doctor

Test-Log (**testid, patient-id**)
Primary key: **testid, patient-id**
Foreign Key: **patient-id** reference Patient
Foreign Key: **testid** reference Test

Performed-By(**testid, doctor-id**)
Primary key: **testid, doctor-id**
Foreign Key: **doctor-id** reference Doctor
Foreign Key: **testid** reference Test

Using the information available in the above relational schema, draw the corresponding ER diagram.

(10 Marks)

Question 3 (25 Marks)

(a) The functional dependencies are relations between two set of attributes from the database. What is the difference between fully functional dependency and partial functional dependency?

(4 Marks)

(b) A functional dependency is a property of the attributes in the relation schema. The database designers identify the most obvious functional dependencies and use Armstrong's inference rules to determine additional dependencies.

The three Armstrong's inference rules Reflexive, Augmentation and Transitive make a sound and complete set of rules. Write down these three Armstrong's inference rules.

$A \subseteq B$ $A \subseteq B$. $B \rightarrow A$. (6 Marks)

(c) Under what circumstances a relation schema violates 1NF.

(3 Marks)

(d) Consider the following relational schema,

Personal(UserId, Email, FirstName, LastName, City, Province, PostalCode)

and the set of functional dependencies given below:

F = {(UserId → Email, FirstName, LastName, City, Province, PostalCode ~~Capacity~~),
(PostalCode → City, Province), (City → PostalCode, Province)}

(i) Find the primary key of the Personal relational schema.

(4 Marks)

(ii) Transform the relation, Personal into relations in 3NF.

(8 Marks)

Question 4 (25 Marks)

Consider the following business scenario that involves a purchase order system:

The suppliers supply items to the purchase orders. A purchase order has one or many line items. A line item is a movie and there would be many video copies produced from a single movie.

The following relational schema has created for the system.

Supplier(**supplierName**: string, address: string)
Primary Key: **supplierName**

PurchaseOrder(**orderId**: integer, date: Date, ***supplierName***: string)
Primary Key: **orderId**
Foreign Key: ***supplierName*** reference Suppler

PurchaseOrderItem(**lineNo**: integer, quantity: integer, unitPrice: float, ***orderId***: integer, ***movieId***: integer)
Primary Key: **lineNo**
Foreign Key: ***orderId*** reference PurchaseOrder
Foreign Key: ***movieId*** reference Movie

Movie(**movieId**: integer, title: string, type: string, length: float)
Primary Key: **movieId**

Video(**videoId**: integer, dateAcquired: Date, **movieId**: integer)
Primary Key: **videoId**
Foreign Key: ***movieId*** reference Movie

The Suppler relation contains supplier details. The PurchaseOrder relation contains order details, while PurchaseOrderItem stores the line item details. The Movie relation contains the details of movies and Video relation contains details of videos.

(a) Write a SQL data definition statement to create the relation "Video", with the relevant constraints.

(4 Marks)

(b) Write a SQL data manipulation statement to insert the record ("1000", "Invasion of Asia", "War", 2.5) to the relation "Movie".

(4 Marks)

(c) Write SQL data retrieval statements to perform the following tasks.

(i) Find names of suppliers who supplied orders on "2016/11/18".

(4 Marks)

(ii) For each movie find the total quantity ordered.

(4 Marks)

(iii) Find the total quantity ordered by the supplier "Malik".

(5 Marks)

(d) Formulate the query in (c) (i) in Relational Algebra.

(4 Marks)

***** END OF THE PAPER *****