University of Sri Jayewardenepura

B.Sc. (General) Degree Second Year

Second Semester Terminal Course Unit Examination – December 2012

CSC 209 2.0 Database Management Systems
(Time: 2 hours)

Answer all questions.

Question 1

(a) A database designer has created a database to store details of employees and projects they are working. The database schema and instance of database are given below.

Database Schema:

Employee_Project (Emp_No:String, Emp_name:String, Address:String, email:String, Project_No:String, Proj_Name:String, Hours:Numeric)

Database instance:

Emp_No	Emp_name	Address	email	Project_No	Proj_Name	Hours
SAP1	Malen	Colombo	malen@gmail.com	P01	Bank_A	45
SAP2	Petric	Galle	NULL	P02	School_A	30
SAP3	Anura	Kandy	NULL	P03	Road_cons_A	45
SAP1	Malen	Colombo	malen@gmail.com	P03	Road_cons_A	45
SAP2	Petric	Galle	NULL	P03	Road_cons_A	30
SAP4	Peter	Colombo	peter@yahoo.com	P02	School_A	35
SAP5	David	Galle	NULL	P01	Bank_A	40
SAP4	Peter	Colombo	peter@yahoo.com	P01	Bank_A	15
SAP2	Petric	Galle	NULL	P01	Bank_A	25
SAP5	David	Galle	NULL	P02	School_A	40

Comment on the above database design, by highlighting the problems that could encounter using such a design.

(b) By providing examples briefly describe the three phases, "Requirements gathering", "Conceptual design" and "Logical design" in the database development life cycle.

(15 Marks)

Question 2

A database is needed to store details of buildings, their owners, owners' food and drinki[ng] habits. A building could use for residential or commercial purpose. Each building has a [t] number, address, floor area and tax rate. For each commercial building its business type [is] stored. For each residential building number of occupants is stored. Each building has an own[er] and for each owner his/her national identification number and name are stored. The owners li[ke] to drink beverages and have favorite foods. For each beverage, beverage name and manufactur[er] are stored. For food its type is stored.

Suppose, you have been entrusted the task of designing a high level description for the above data requirements that satisfies the following conditions:

1. There must be at least six entity types
2. There must be at least one union type (category) relationship.
3. There must be at least three regular entity type relationships.

Design and draw an extended entity relational (EER) diagram to represent the above information. Clearly show the multiplicities and constraints (overlap, disjoint, total, and partial) involved. If any assumptions are made, state them.

(20 Marks)

Question 3

(a) Consider the database instance given in question 1.

   (i) Identify all functional dependencies that you can derive from this database instance.

   (ii) Hence, find the candidate key(s) for this relation.

(b) (i) The relational design shown below violates 1NF. Convert the design to INF which will store the same information.

     Customer(*customer_id*, name, {Account_number, type})

   (ii) The relation given below violates 2NF. Convert the design to 2NF, which will store the same information.

     Transaction(*customer_id, Account_number, Date_time*, customer name, amount)

   (iii) The relation given below violates 3NF. Assume that spouse's national id determine[s] relationship to the customer. Convert the design to 3NF, which will store the same information.
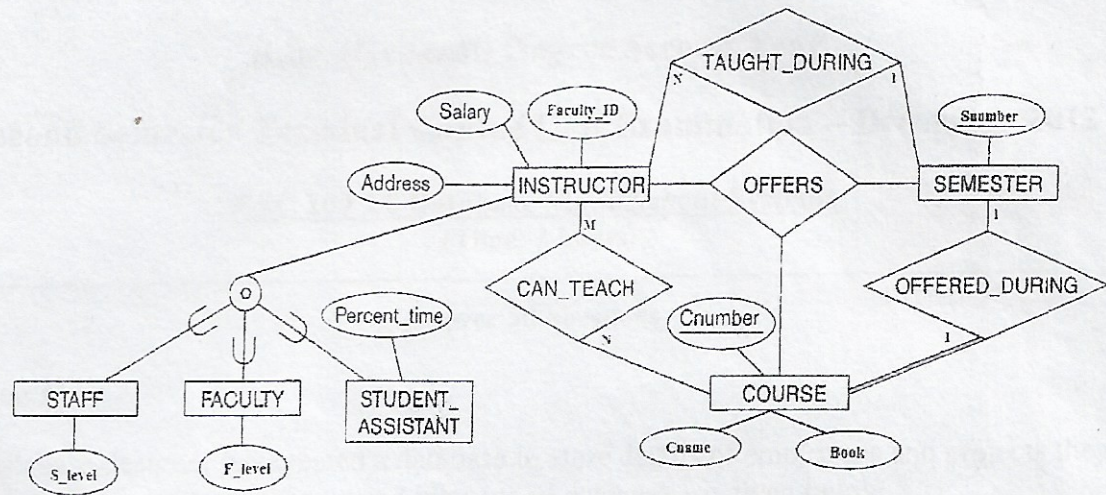
     Spouse(*customer_id*, name, spouse_national_id, relationship_to_customer)

(25 Marks)

Question 4

Map the following EER schemas into relational schemas, and specify all primary keys and foreign keys.

(15 Marks)

Question 5

Consider the following relational schema,

Bird (*bird_id*:String(6), name:String(20), can_sing:Boolean(1), home_id:String(6))
Forigen key: Bird.home_id reference Birdhouse

Tree (*tree_id*:String(6), type:String(10))

Birdhouse (*bird_home_id*:String(6), tree_id:String(6), height:Integer(2))
Forigen key: Birdhouse.tree_id reference Tree

Primary keys are under lined and all columns are defined as NOT NULL.

(a) Write SQL expressions to do the following tasks.

(i)   To create the relation Bird.
(ii) List tree_id and tree_type where birds who can sing are living and having a bird house of height 40 cm.
(iii) List all tress not having any bird house.
(iv) For each tree find the number of birds who can sing are living.
(v)   Find the tree type where birds who can sing are living.

(b) Also, write the relational algebra expressions for queries (ii) and (iii) given in part (a).

(25 Marks)

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