Eastern University, Sri Lanka
Second Examination in Science (2003/2004)
Second Semester (June/July, 2005)
CS 203-Database Design

Answer all Questions   **Time: 2 hours**

1. Define what *Functional Dependency* is.

    Define what is meant by *Second Normal Form* and what is meant by *Third Normal Form*.

    Suppose you are given the form shown below. Assume that a video cannot be rented on more than one receipt on a day.

    The following receipt shows the customer Moore's personal details such as name, phone number, city and street and details about the videos rented by Moore. Only one receipt will be issued for a person on a particular day. Each video will have a unique ID and its other details such as type, title, cost per a day, the maximum number of days a customer can have without penalty etc. The cost and the number of days may vary depending on the type.

Sun Video

Person ID: 226			Receipt: 68395	
Name: Moore			Date: 9/1/05	
Phone: (734)763-4385				
City: Colombo				
Street: Main Street				
Video Information				
ID	Name	Type	Days	Cost
325	Shrek	N	1	3.00$
548	Remembering the Titan	H	2	2.50$
6437	The replacement Killers	H	2	2.50$

[to be continued...]

    i   Draw a dependency diagram.

    ii   Change to1NF relation.

    iii   Change to 2NF relations. Identify the identifiers of these relations.

    iv   Identify any transitive dependencies.

    v   Write the 3NF relations.

2.

(a) Suppose that you are asked to model human resources in a University.

For each person, you store id, name, address, gender and date of birth. Employees who work for the University, student who attend classes, alumnus who have graduated are involving in University System. A person might belong to alumnus and employee. Each instance of employee has a value for date-hired and salary. Major-department is an attribute of student, and degree (with components year, degree and date) is a property of alumnus. Employee is partitioned into two type faculty and staff. While staff has the specific position, faculty has the specific rank. However an employee cannot be both faculty and staff at the same time. Student may be a graduated student or under graduated student. While graduate student has test-score, under graduated student has year-standing.

Design an Entity-Relational schema and draw an Entity-diagram for the schema. Specify key attributes of each entity type and structural constraints on each relationship type.

(b) Represent the following, using the constructs of ER model.

    i.   A company produces CDs with a code and a title; each CD has been recorded by one or more singer, each of whom has a name and an address and some of whom have a stage name too.

    ii.   In a zoological garden there are animals belonging to different species and ages; each species is situated in a sector (having name) of the zoo.

Q3)

What do you meant by the word **Relational algebra**?

Briefly explain the operations on Relational algebra.

Consider the relational employee database:

employee (employee-name, street, city)

works (employee-name, company-name, salary)

company (company-name, city)

manages (employee-name, manager-name)

Give an expression in relational algebra to perform each of the followings tasks:

(a) Find the names of all employees who work for First Bank Corporation.

(b) Find the names and cities of residence of all employees who work for First Bank Corporation.

(c) Find the names, street address, and cities of residence of all employees who work for First Bank Corporation and earn more than $10,000 per annum.

(d) Find the names of all employees in this database who live in the same city as the company for which they work.

(e) Find the names of all employees who live in the same city and on the same street as do their managers.

(f) Find the names of all employees in this database who do not work for First Bank Corporation.

(g) Find the names of all employees who earn more than every employee of Small Bank Corporation.

(h) Assume that companies may be located in several cities. Find all companies located in every city in which Small Bank Corporation is located.

Q4)

Given the following schema:

employee (emp#, eName, job, manager#, hire-Date, salary ,commission, deptNo)
department (deptNo, dName, loation)
SalaryGrade (grade, Low-Salary, high-Salary)

Write a SQL query or set of queries to find out the answer to each of the following questions:

(i) What are the names of the employees that have salaries between 1000 and 2000?

(ii) What are the names of the employees working in **Dallas** or **New York**?

(iii) What are the employees that earn more than their manager?

(iv) What is the average salary for each job?

(v) What are the names of the salesmen who have an income (salary plus commission) above 2000?

(vi) What are the managers that earn more than any of their employees?

(vii) What are the names of the employees who are managers of at least three salesmen?

(viii) Who is the lowest paid employee in **Dallas**?

(ix) What are the names of the employees who were hired before their manager?

(x) For how many employees is in the case that the employee and his/her manager work in different towns?

(xi) How many employees have a higher salary than the average salary of all employees working in the same town?

(xii) Which is the town with the lowest average salary grade?

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