UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

MAIN EXAMINATION, DECEMBER 2007

Title of Paper   :   Databases and their Design I

Course Number   :   CS 345

Time Allowed   :   Three (3) Hours

Instruction   :   Answer **ANY FIVE** questions

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Question 1

(a) Differentiate between a database management system and a database administrator. [4]

(b) Briefly describe, with the aid of an example, redundancy and the problems associated with it. [4]

(c) Why is it necessary to specify integrity constraints when designing a database. [4]

(d) Describe four different end users (in databases) with their associated tasks. [8]

Question 2

(a) What are the advantages of the hierarchical model over the relational data model? What are the disadvantages? [5]

(b) How can a network that is not a perfect tree be implemented by means of a hierarchical model DBMS? [4]

(c) How is abstraction an advantage in database systems? [3]

(d) Describe the three-schema architecture of a database system. [8]

Question 3

(a) Differentiate between an entity type and an entity set. [4]

(b) The University of Learning admits either post-graduate students or undergraduate students. Every student: has a unique id number, a name (made up of first name, initial, and last name), an address, and date of birth; is enrolled in some department and has a guardian. Post-graduate students do research projects which must have a title, deadline for submission and the name of a supervisor. Undergraduates follow a given program in some academic year and do a number of courses.
   (i) Draw an ER diagram that emphasizes the similarities between the postgraduate students and the undergraduates. Specify the guardian's attributes. [8]
   (ii) Break down the ER diagram into tables. [8]

Question 4

(a) Why is an ER diagram desirable? [5]

(b) Draw an ER schema diagram to represent some company's database. [15]
   The company employees are associated with a department. Each employee identified by a pin number, name, date of birth, address, salary and gender. Every department in the company has a name, locations, and a number. The departments are assigned projects that they control. Each project has a location, name and number. Each department has a manager, from the pool of employees, the other employees service the department. Other than working for a department or managing it each employee is either a supervisor or is supervised.

Question 5

a) Composite and multivalued attributes can be nested to any number of levels. Suppose we want to design an attribute for a STUDENT entity type to keep track of previous college education. Such an attribute will have one entry for each college previously attended, and each such entry will be composed of college name, start and end dates, degree entries (degrees awarded at that college, if any), and transcript entries (courses completed at that college, if any). Each degree entry contains the degree name, month and year the degree was awarded, and each transcript entry contains a name, semester, year and grade. Design an attribute to hold this information. (Either a table form or short notation).   [10]

b) Show an alternative design for a) that uses entity types (including weak entities) and relationship types.   [10]

Question 6

Given the following relations:
    Employee(Fname,Minit, Lname,EmplPin, Bdate, Address, Sex, Salary, Super_Pin,Dnum)
    Department(Dname, Dnum, Mgr_Pin, Mgr_start_date) Dep_Loc (Dnum, Dloc)
    Project (Pname, Pnum, Ploc, Dnum)   Works_On (Pin, Pnum, Hours)
    Dependent (EmplPin, Dependent_name, Sex, Bdate,

Specify the following algebraic queries for the database schema.

a) Retrieve the names of all employees in department 5 who work more than 10 hours per week on ProductX project.   [2]
b) List the names of all employees who have a dependant with the same name as themselves.   [2]
c) Find the names of all employees who are directly supervised by Franklin Wong.   [2]
d) For each project, list the project name and total hours per week (by all employees) spent on that project.   [2]
e) Retrieve all the names of employees who work on any project.   [2]
f) Retrieve names of all employees who do not work on any project.   [2]
g) For each department retrieve the department name and the average salary of all employees working in that department.   [2]
h) Retrieve the average salary of all female employees.   [2]
i) Find the names and addresses of all employees who work on at least one project located in Houston but whose department has no location in Houston.   [2]
j) List the last names of all department managers who have no dependents.   [2]