ROLL NO. _____

Code: CT13 Subject: DATABASE MANAGEMENT SYSTEMS

ALCCS - NEW SCHEME

Time: 3 Hours **FEBRUARY 2012** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE:

- **Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.**
- **Parts of a question should be answered at the same place.**

Q.1 a. Write the difference between Database system and File system.

b. Briefly explain Heuristics based optimization.

c. Define Super key, Candidate key, Primary key and Foreign key.

d. List at least two reasons why database systems support data manipulation using a declarative query language such as SQL, instead of just providing a library of C or C++ functions to carry out data manipulation.

e. Represent the natural join operation of the relational algebra as a combination of Cartesian product, selection and projection operation.

f. Define domain integrity constraint, entity integrity constraint and referential integrity constraint.

g. Define data independence. Differentiate between logical and physical data independence. **(7 × 4)**

Q.2 a. Discuss the different types of constraints on Generalization/Specialization. **(6)**

b. Composite and multi-valued 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 this entry is 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 is formed of degree name and the month and year it was awarded, and each transcript entry is formed of a course name, semester, year, and grade. Design an attribute to hold this information. **(6)**

c. How would the following ER constructs be mapped to the relational model.
(i) Aggregation.
(ii) Strong and weak entity set.
(iii) Generalization / Specialization. **(6)**

Q.3 For the following University database

A University has Students(ID, Name, Age, Degree), Professors(Id, Name, Age, Rank, Specialization), Departments(Number, Name, Building) and Projects(Number, Name, Duration, Budget). A project is managed by one professor can be worked on by one or more professors. A professor can manage and work on many projects. A student can work on many projects and a project can have many students. A student has professor as his supervisor in each project he/she works on. Departments have a professor who runs the department. Professors work in one or more departments for a pre-determined amount of time. A student registers to one main department where he/she has a senior students as his/her advisor who advices on the courses a student should take. Courses offered can be Core or Elective and student have to opt for at least two core courses.

(i) Draw an E-R diagram. **(9)**

(ii) Transform the E-R diagram to a normalized relational scheme. **(9)**

Q.4 Consider the following relational schema

EMPLOYEE(EmpNo, EmpName, MgrNo, Job, Salary, DeptNo)

DEPARTMENT(DeptNo, DeptName, DeptLoc)

Where MgrNo is one of the EmpNo.

a. Give an SQL DDL definition of this database. **(2)**

b. Express the following queries in SQL

(i) Find the names of the employees whose salary is greater than the average salary of their department.

(ii) Find the names of employee who are getting the third highest salary.

(iii) Find the names of employees and the names of their managers.

(iv) Find the names of departments whose average salary is greater than the average salary of all departments. **(10)**

c. Update DeptNo of all employees who are engineers with DeptNo of department located at London. **(3)**

d. Delete employees who have no departments assigned. **(3)**

Q.5 a. Define Lossless Join Decomposition and Dependency Preservation. Suppose that we decompose the schema R={A, B, C, D, E} into R1={A, B, C} and R2={A, D, E}. Verify whether this decomposition is Lossless or Lossy if the Functional Dependencies $A \rightarrow BC$, $CD \rightarrow E$, $B \rightarrow D$ and $E \rightarrow A$ holds. Also verify whether the decomposition is dependency preserving. **(5)**

b. Consider a relation R(A, B, C, D) with the set of FD's $F = \{B \rightarrow AC, AB \rightarrow D, D \rightarrow C, BC \rightarrow D\}$. Find the canonical cover for F. **(5)**

c. Consider the following relation, R{A, B, C, D, E} with the set of FD's $F = \{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$. List the candidate keys of R. **(4)**

d. Consider the relation schema R(A, B, C, D, E) with the set of functional dependencies $F = \{AB \rightarrow CE, E \rightarrow AB, C \rightarrow D\}$. What is the highest normal form for R. **(4)**

Q.6 a. Consider the three transactions T_1, T_2, and T_3, and the schedules S_1 and S_2 given below. Draw the serializability (precedence) graphs for S_1 and S_2 and state whether schedule S_1 and S_2 are serializable or not. If a schedule is serializable, write down the equivalent serial schedule(s).

T_1: $r_1(x)$; $r_1(z)$; $w_1(x)$
T_2: $r_2(z)$; $r_2(y)$; $w_2(z)$; $w_2(y)$
T_3: $r_3(x)$; $r_3(y)$; $w_3(y)$
S_1: $r_1(x)$; $r_2(z)$; $r_1(x)$; $r_3(x)$; $r_3(y)$; $w_1(x)$; $w_3(y)$; $r_2(y)$; $w_2(z)$; $w_2(y)$
S_2: $r_1(x)$; $r_2(z)$; $r_3(x)$; $r_1(z)$; $r_2(y)$; $r_3(y)$; $w_1(x)$; $w_2(z)$; $w_3(y)$; $w_2(y)$ **(10)**

b. What is multiple-granularity locking? In multiple-granularity locking, what is the difference between implicit and explicit locking? **(4)**

c. Prove that two-phase locking protocol leads to conflict serializability of schedules.**(4)**

Q.7 Write short notes on any **THREE** of the following:

(i) Data Mining.
(ii) Data Warehousing.
(iii) Distributed Database.
(iv) OLTP and OLAP.
(v) Database Recovery. **(6×3)**