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UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

FINAL EXAMINATION, 2005

Title of Paper	:	Databases and their Design
Course Number	:	CS 340 (II)
Time Allowed	:	Three (3) Hours
Instruction	:	Answer any **FIVE** questions

This exam paper should not be opened until permission has been granted by the invigilator.

1. At the University of Learning there are post-graduate students and undergraduate students. Each student at this University has a name, a family name, date of birth and a unique student identity number. Each post graduate student must complete a research project for which there is a set date for thesis submission and another set date for an oral examination based on the submitted thesis. Each undergraduate student follows a particular program in which there are two major subjects with a number of courses in each major subject.

   (a) Work out good names for the involved entities and represent this database in an E-R diagram – showing all primary keys. [12]

   (b) Reduce the above E-R diagram into all possible tables. [8]

2. Consider the given sample relational database for MMU Ltd and write an SQL query to do the following:

   (a) Create the relation DEPENDENT [5]
   (b) List the name, date of birth, relationship of any dependent whose guardian (from EMPLOYEE) earns more than $25000. Write this query in two ways; one in a straightforward manner and as a nested query. [8]
   (c) Change the address of John B. Smith to 730 Dallas, Houston TX. [3]
   (d) List the last name, first name, address, social security number (ssn) and age of every employee. [4]

3. (a) Differentiate between a unary and a binary operation in relational algebra [4]

   (b) Give relational algebra queries to do the following:
      (i) Question 2 (b). [4]
      (ii) List the first name, last name of each employee together with the name of their spouse for all employees who have spouses. [4]
      (iii) List the names of dependents who are females or are spouses. [4]
      (iv) Add the new attribute DEPT_TYPE and set it to MNGMNT (management) for all existing departments. [4]

4. (a) Using the same database as in question 2, write a relational algebra query to list the first names of all the employees who live in the same city as James E. Borg. [6]

   (b) What is the use of indexes in database systems? [2]
   (c) Discuss one advantage and two disadvantages of using indexes. [6]
   (d) The system catalog is useful in carrying information about tables. They generally contain three tables– list these tables and state what information each one of them carries. [6]

5. Consider an AIRLINE relational database which describes a database for airline flight information. Each FLIGHT is identified by a flight NUMBER, and consists of one or more flight ROUTES with ROUTE NUMBERS 1, 2, ... Each route has scheduled arrival and departure times and airports and has many ROUTE INSTANCEs – one for each DATE on which the flight travels. FARES are kept for each flight. For each route instance, SEAT RESERVATIONS are kept, as are the AIRPLANE used on the route and actual arrival and departure times and airports. An AIRPLANE is identified by an AIRPLANE_ID and is of a particular AIRPLANE_TYPE. CAN_LAND relates AIRPLANE_TYPES to the AIRPORTs in which they can land safely. An AIRPORT is identified by an AIRPORT_CODE. Specify the following queries in relational algebra:

   (a) For each flight, list the flight number, the departure airport for the first route of the flight, and the arrival airport for the last route of the flight. [5]
   (b) List the flight numbers and weekdays of all flights or flight routes that depart from Houston International Airport (airport code IAH) and arrive in Los Angeles International Airport (airport code LAX). [5]
   (c) List the flight number, departure airport code, scheduled departure time, arrival airport code, scheduled arrival time, and weekdays for all flights or flight routes that depart from some airport in the city of Houston and arrive at some airport in the city of Los Angeles. [5]
   (d) Retrieve the number of available seats for flight number 'CO197' one '10-OCT-90'. [5]

6. Specify the queries for question #5 in SQL. [20]

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MMU Ltd sample Database

EMPLOYEE	FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO
	John	B	Smith	123456789	09-JAN-55	731 Fondren, Houston, TX	M	30000	333445555	5
	Franklin	T	Wong	333445555	08-DEC-45	638 Voss, Houston, TX	M	40000	888665555	5
	Alicia	J	Zelaya	999887777	19-JUL-58	3321 Castle, Spring, TX	F	25000	987654321	4
	Jennifer	S	Wallace	987654321	20-JUN-31	291 Berry, Bellaire, TX	F	43000	888665555	4
	Ramesh	K	Narayan	666884444	15-SEP-52	975 Fire Oak, Humble, TX	M	38000	333445555	5
	Joyce	A	English	453453453	31-JUL-62	5631 Rice, Houston, TX	F	25000	333445555	5
	Ahmad	V	Jabbar	987987987	29-MAR-59	980 Dallas, Houston, TX	M	25000	987654321	4
	James	E	Borg	888665555	10-NOV-27	450 Stone, Houston, TX	M	55000	null	1

DEPT_LOCATIONS	DNUMBER	DLOCATION
	1	Houston
	4	Stafford
	5	Bellaire
	5	Sugarland
	5	Houston

DEPARTMENT	DNAME	DNUMBER	MGRSSN	MGRSTARTDATE
	Research	5	333445555	22-MAY-78
	Administration	4	987654321	01-JAN-85
	Headquarters	1	888665555	19-JUN-71

WORKS_ON	ESSN	PNO	HOURS
	123456789	1	32.5
	123456789	2	7.5
	666884444	3	40.0
	453453453	1	20.0
	453453453	2	20.0
	333445555	2	10.0
	333445555	3	10.0
	333445555	10	10.0
	333445555	20	10.0
	999887777	30	30.0
	999887777	10	10.0
	987987987	10	35.0
	987987987	30	5.0
	987654321	30	20.0
	987654321	20	15.0
	888665555	20	null

PROJECT	PNAME	PNUMBER	PLOCATION	DNUM
	ProductX	1	Bellaire	5
	ProductY	2	Sugarland	5
	ProductZ	3	Houston	5
	Computerization	10	Stafford	4
	Reorganization	20	Houston	1
	Newbenefits	30	Stafford	4

DEPENDENT	ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP
	333445555	Alice	F	05-APR-76	DAUGHTER
	333445555	Theodore	M	25-OCT-73	SON
	333445555	Joy	F	03-MAY-48	SPOUSE
	987654321	Abner	M	29-FEB-32	SPOUSE
	123456789	Michael	M	01-JAN-78	SON
	123456789	Alice	F	31-DEC-78	DAUGHTER
	123456789	Elizabeth	F	05-MAY-57	SPOUSE