

**NAPIER UNIVERSITY**  
**DEPARTMENT OF COMPUTING**

**RESIT DIET - SESSION 1997-98**

**DATABASE SYSTEMS 2 - MODULE NO: CS22004**

**DATE:** 20 AUGUST 1998

**TIME ALLOWED:** 2 HOURS

START TIME: 1300 HOURS

FINISH TIME: 1500 HOURS

**EXAMINERS:**

PETER BARCLAY  
JESSIE KENNEDY  
JON KERRIDGE

**QUESTION PAPER DATA**

Number of Questions - FIVE

Number of Pages – FIVE

This is an Open Notes Exam

**INSTRUCTIONS TO CANDIDATES**

Answer any THREE questions

USE SEPARATE SCRIPT BOOK FOR EACH QUESTION

**SCENARIO** (To be used in several of the following questions)

Arfur Daley Enterprises runs a high quality car sales operation for which they provide a complete customer after sales service. In order to provide this service they keep records of the service needs of each type of car that they sell. This information includes how often a service is required in terms of the number of months between services and the distance covered. A car is serviced either when a predefined period has elapsed or the vehicle has covered a specific distance, whichever is the sooner. A record is kept of the names and addresses of car owners. For each car that a customer owns a record is kept of the registration number of the car, the type of car, the date it was sold to the customer, the recorded distance travelled by the vehicle and the average distance undertaken by the owner per month. When a customer makes a booking for a service a record is kept of the registration number of the vehicle and the date for which the service has been booked. Finally, a record is kept of the service history of a car which includes the dates upon which the vehicle was serviced, the registration number of the vehicle and the vehicle mileage when the service was carried out.

The primary goal of the computer system is to be able to send reminders to customers that a vehicle they own is due for service.

The following gives the structure of a suitable set of tables to hold this information. Table names are shown as **TABLE\_NAME**, Column names are shown as **COLUMN\_NAME**. A description of the column is given in lower case letters.

**OWNERS**

CUSTOMER_ID	unique customer identification number
NAME	customer name
ADDRESS	customer address
PHONE_NUMBER	customer phone number

**CARS**

REGISTRATION_NUMBER	vehicle registration number
CUSTOMER_ID	customer identification of car owner
CAR_TYPE	type of car
DATE_SOLD	date of sale of vehicle to owner
INITIAL_DISTANCE	distance of vehicle on day of sale
AVE_MONTHLY_DISTANCE	average monthly distance covered by owner

**SERVICE\_REQUIREMENTS**

CAR_TYPE	unique identification of a car type
FREQUENCY_BY_MONTHS	interval in months between services
FREQUENCY_BY_DISTANCE	normal distance covered between services

**SERVICE\_HISTORY**

REGISTRATION_NUMBER	vehicle registration number
DATE_SERVICED	date of service
DISTANCE	recorded distance from vehicle

**SERVICE\_BOOKING**

REGISTRATION_NUMBER	vehicle registration number
DATE_OF_SERVICE	date booked for service

1. (a) Define the concepts of *entity integrity* and *referential integrity* with respect to the relational model.

(4)

- (b) An agency called *Instant Cover* supplies part-time/temporary staff to hotels within Scotland. The table below lists the time spent by agency staff working at various hotels. The National Insurance Number (NINo) is unique for every member of staff. (Note that the Contract No is always dependent on the Hotel No but not vice-versa).

<u>NINo</u>	<u>Contract No</u>	Hours	Emp_Name	Hotel_No	Hotel_Loc
1025	C1023	15	Nesbit R.	H22	Paisley
1156	C1023	22	Jolly I.	H22	Paisley
1067	C1024	26	Fulton R.	H6	Glasgow
1125	C1025	12	Nesbit R.	H6	Glasgow

The table shown above is susceptible to update anomalies. Provide an example of each of an insertion, deletion and update anomaly.

(6)

- (c) Show all the functional dependencies in the above relation and illustrate the process of normalising the above table to BCNF. State any assumptions that you make about the data shown in the table.

(10)

- (d) Discuss why a relation might be denormalised after the process of normalisation has been carried out.

(5)

Total marks [25]

2. (a) Describe the different types of domain constraint and their use in a database model. (8)
- (b) Suggest suitable domain constraints for those columns of all the tables in the Arfur Daley scenario that are neither primary or foreign keys. (7)
- (c) For the Arfur Daley scenario, construct SQL statements for the following queries commenting on the importance of any domain constraints you have suggested in part (b).
- (i) A list of customers names and addresses who travel more than 1000 miles per month and whose car is more than three years old. (5)
- (ii) A list of customers whose average monthly distance is greater than that suggested by the service requirements for the car they own. (5)

Total marks [25]

3. (a) Database transactions are often described as being Atomic, Consistent, Isolated, Durable (ACID). Briefly describe the significance of each of these four terms. (8)
- (b) Define the term 'lock' as used referring to concurrency in database systems, and describe briefly what locks are used for. (4)
- (c) By using an example based on the Arfur Daley Enterprises database:
- (i) Illustrate the Lost Update problem which may occur during concurrent access to a database. (5)
- (ii) Rework your example from part (c)(i), showing how the problem could be overcome by use of locks. (3)
- (d) Describe the back-up strategy you would recommend for Arfur Daley Enterprises database, discussing both the type and frequency of back-ups required, and how – if necessary – recovery could be effected. State any necessary assumptions you have made about typical use of the database. (5)

Total marks [25]

4. Discuss the rôle and responsibilities of the database administrator (DBA) of a large, shared relational database system, giving examples where appropriate.

Total marks [25]

5. (a) Explain the difference between a view and a cursor as understood in a relational database system using SQL as its query language.

(5)

- (b) At the end of each week Arfur Daley needs to update the CARS table to reflect the current average monthly distance covered by each vehicle that has been serviced that week. Suggest a suitable justification of the choice in each case where:

- (i) Arfur Daley operates in one town with one service facility serving 500 customers and a view is to be used,

(4)

- (ii) Arfur Daley operates throughout Scotland and serves 50000 customers and a cursor is to be used.

(4)

- (c) Construct the formulation of one or more SQL **views** to undertake the processing required in part (b) above. You should also include any UPDATE and DELETE statements required. You may assume that a date function MONTHS (x,y) exists which returns the number of months between two dates (x) and (y) where (x) is before (y).

(12)

Total marks [25]

END OF PAPER