

**OLLSCOIL NA hÉIREANN, GAILLIMH****National University of Ireland, Galway****Semester Two Examinations, 1999/2000****Higher Diploma in Systems Analysis  
(Business Systems Development)****DATABASE LANGUAGES (MS879)****Professor R. O'Callaghan****Professor J. F. Collins****Mr. M. A. Lang**Time allowed: **THREE** hoursAnswer **QUESTION 3** and any **TWO OTHER** questions

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1. (a) What are the decisive factors in the selection of the primary key of a table?  
(9 marks)

- (b) Describe, using examples, how recursive relationships and entity sub-types may be physically implemented in a relational database.

*or*

Describe, using examples, how anomalies can arise in un-normalised tables when inserting, deleting or updating data.

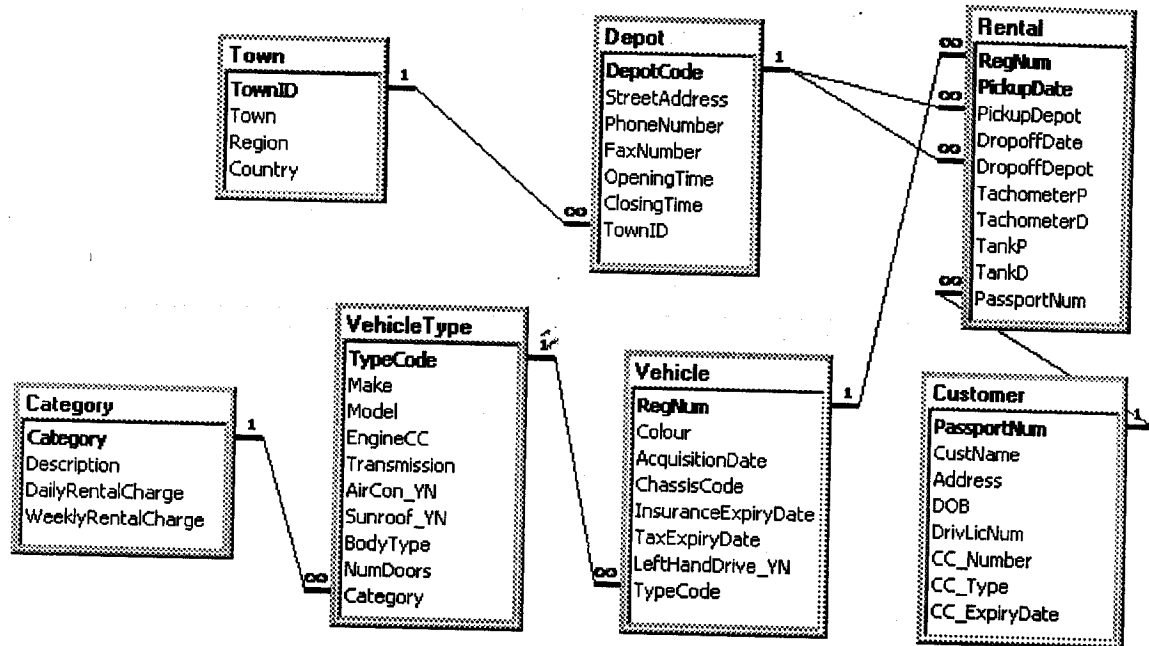
(16 marks)

2. The World Wide Web had its beginnings in file-based technology, but in recent years the Web has become closely connected with database systems. The integration of Web and database technologies is highly advantageous with regard to the development of robust, reliable business Web sites.

Discuss this statement.

(25 marks)

3. Given the following database schema, which represents a **Vehicle Rental System**, you are required to provide the SQL commands to implement exercises (a) to (r) below, taking notes (i) to (ix) into consideration.



#### Notes:

- i) In the **Rental** table, the fields **TachometerP** and **TachometerD** record the tachometer readings ("trip counter") of the vehicle in kilometers at date of pick-up and date of drop-off respectively.
- ii) In the **Rental** table, the fields **TankP** and **TankD** record the petrol tank levels of the vehicle in litres at date of pick-up and date of drop-off respectively.
- iii) If the petrol tank level at date of drop-off (**TankD**) is less than that at date of pick-up (**TankP**), a refill charge is incurred.
- iv) If a vehicle is dropped off in a town other than that in which it was picked up, a drop-off charge is incurred. If a town has more than one depot (perhaps, at the airport, the railway station, and / or the city centre), it is allowable to pick up from one depot and return to another in the same town without incurring a drop-off charge.
- v) The **DailyRentalCharge** and **WeeklyRentalCharge** as recorded in the **Category** table are denominated in Euros.
- vi) The basic charge periods are per day and per week. If, for example, the daily rental charge for a vehicle were 35 Euros and the weekly rental charge were 200 Euros, a 4-day-rental would cost 140 Euros ( $4 * 35$ ) whereas a 9-day-rental would cost 270 Euros ( $200 + 2 * 35$ ).
- vii) The Transmission of a vehicle is either "Automatic" or "Manual".

- viii) The **BodyType** of a vehicle is "Hatchback", "Sedan", "Estate", or Null.
- ix) **AirCon\_YN**, **Sunroof\_YN** and **LeftHandDrive\_YN** are all boolean Yes/No fields with values "Y" or "N" which indicate whether or not a vehicle has air conditioning, a sunroof, and left-hand-drive respectively. If a vehicle does not have left-hand-drive, it is implicitly assumed to have right-hand-drive.

**Exercises:**

- a) List the street address, town, and hours of business of all depots in the Andalusia region of Spain.  
(1 mark)
- b) Special deals are available to customers who are American Express (AMEX) credit card holders, and the company wishes to notify these customers of offer details. Generate a list of the names and addresses of all customers who hold AMEX cards.  
(1 mark)
- c) Delete details of all rentals that occurred previous to 1999.  
(1 mark)
- d) List the registration numbers of all vehicles that are due to be taxed and / or insured in July 2000.  
(2 marks)
- e) List the street address, town, region and country of all depots that presently do not have a fax machine installed.  
(2 marks)
- f) How many right-hand-drive Peugeot 306s does the company have in its fleet? (See Note ix)  
(2 marks)
- g) A customer has requested to rent a 4-door 1600cc Ford Focus hatchback with automatic transmission and air conditioning for ten days. How much will it cost? (See Notes v, vi, vii, viii, and ix)  
(2 marks)
- h) List the names of all towns in the Bavaria region of Germany that have two or more depots.  
(2 marks)
- i) Due to a production fault that has been observed by the manufacturer, all vehicles whose chassis code starts with characters "CDGZ1K9" are to be recalled. List the registration numbers of the affected vehicles. (Hint: use pattern-matching)  
(2 marks)
- j) The rental charges for vehicles in categories A, B, and C is to be increased by 3%, and the charges for all other categories is to be increased by 5%. Implement these updates.  
(2 marks)

- k) A new depot is being opened at the Ferryport in Rosslare in the Leinster region of Ireland. It shall be open each day from 0800 to 1900, and the telephone number is 053-7503010. Create this new record. (Note: Assume that Rosslare is already defined in the Town table).  
(2 marks)
- l) Provide the SQL code necessary to create the Rental table.  
(2 marks)
- m) List the make, model, colour, body type and registration number of the most recently acquired vehicle(s).  
(3 marks)
- n) The Italian police wish to locate the driver of a car, registration number "BO36127", which is alleged to have driven away from a filling station outside Verona without paying on May 15, 2000. Find the name, address, passport number and date of birth of the customer to whom that car was rented on that date.  
(3 marks)
- o) The company is offering a loyalty bonus to all customers who clocked up 3000km or more in 1999. Generate a list of these customers. (See Note i)  
(5 marks)
- p) List all details of rentals which incurred drop-off or refill charges. (See Notes ii, iii and iv)  
(5 marks)
- q) Of all vehicles in the fleet, what is the most common colour? (Hint: use a view)  
(5 marks)
- r) It costs 3000 Euros per annum to insure vehicles whose engine capacity is 1400cc or less, and 5000 Euros per annum to insure those of higher engine capacity. Based on the current fleet of vehicles, what is the total annual cost of insurance?  
(8 marks)

**(Total marks for Question 3: 50 marks)**

4. Transaction management is a vital function of a database management system (DBMS) and is critical to assuring data integrity, particularly in a multi-user environment, and even more so where data is distributed.

Discuss this statement.

**(25 marks)**

5. Describe your understanding of each of the following database concepts, and show how they are implemented in SQL-compliant relational databases:

- |                                |                  |
|--------------------------------|------------------|
| (a) Entity integrity           | <b>(3 marks)</b> |
| (b) Domains (allowable values) | <b>(4 marks)</b> |
| (c) Referential integrity      | <b>(6 marks)</b> |
| (d) Views                      | <b>(6 marks)</b> |
| (e) Many-to-many relationships | <b>(6 marks)</b> |

**(Total marks for Question 5: 25 marks)**