

2000 Paper 12 Question 9

Databases

What is meant by a *functional dependency* between sets of attributes in a relational database schema? What conditions must be satisfied for a relation to be in Boyce–Codd Normal Form (BCNF)? [4 marks]

The Department of Transport is implementing plans to tax traffic congestion. From 2002, cars will carry approved radio-control units which at first will be used only to monitor vehicle movement. In controlled areas sensors identify all vehicles, recording their positions periodically. Amber signs flash when overall traffic flow drops below some threshold, and vehicles within the controlled area may be fined for lack of progress.

The owner of each vehicle has an account with the Department of Transport; owners can transfer funds to ensure that their account is in credit. Once credit is exhausted the level of fine increases by a factor 3, and a summons is sent by mail to the vehicle owner’s registered address. In order to maintain proper accounts it is essential to keep an accurate record of each monitored offence.

You are employed to design the relational database that will enforce the scheme, including provision for vehicle and driver registration, monitoring of vehicle offences and management of vehicle accounts. Describe the schema you propose, stating clearly any assumptions that you make. You need not discuss the calculation of the fines due. [12 marks]

Outline the flow of information through the database. To what extent does the application require real-time transaction programming? [4 marks]