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CSE 572

12 May 12, 2019

- 14.8 The table below lists customer/car hire data. Each customer may hire cars from various outlets throughout Glasgow. A car is registered at a particular outlet and can be hired out to a customer on a given date.

jobID	pickupDateTime	driverID	dFName	dLName	clientID	cFName	cLName	cAddress
1001	25/07/00.10.00	I456	Jane	Watt	C034	Anne	Way	111 Storrie Road, Paisley
1102	29/07/00.10.00	I456	Jane	Watt	C034	Anne	Way	111 Storrie Road, Paisley
1203	30/07/00.11.00	I344	Tom	Jones	C034	Anne	Way	111 Storrie Road, Paisley
1334	2/08/00.13.00	I666	Karen	Black	C089	Mark	Fields	120 Lady Lane, Paisley
1455	2/08/00.13.00	I957	Steven	Smith	C019	John	Brown	13 Renfrew Road, Paisley
1676	25/08/00.10.00	I344	Tom	Jones	C039	Karen	Worth	34 High Street, Paisley

- (a) The data in the table is susceptible to update anomalies. Provide examples of how insertion, deletion, and modification anomalies could occur on this table.
- (b) Identify the functional dependencies represented by the data shown in the table. State any assumptions you make about the data.
- (c) Using the functional dependencies identified in part (b), describe and illustrate the process of normalization by converting Table 1 to Third Normal Form (3NF) relations. Identify the primary and foreign keys in your 3NF relations.
- A. **Example of insertion anomaly:** Suppose we wanted to add a new record to this table for a new driver whose ID is 1234. The job ID in this could not be null. Imagine if the driver is new and not allocated to any jobs as of now. In this case, we will not be able to insert the driver's information in this table
- Example of deletion anomaly:** In the above table, if we want to remove the record for a client with client id C089, the record deletion will lead to loss of information of driver also with the driver id 1334. Similarly, in the case of client IDs C019 and C039
- Example of update anomaly:** Suppose in the provided table, Anne Ways address is wrong and needs to be updated, we will need to update it three times.
- B. **Functional dependencies**

ClientID \rightarrow cFName

ClientID → cLName

ClientID → cAddress

driverID → dFName

driverID → dLName

C. UNF

jobID	pickupDateTime	driverID	dFName	DLName	ClientID	cLName	cLName	CAddress
1001	25/07/00.10.10	I456	Jane	Watt	C034	Anne	Way	111 storrie Road, paisley
1001	29/07/00.10.00	I456	Jane	Watt	C034	Anne	Way	111 storrie Road, paisley
1203	30/07/00.11.00	I344	Tom	Jones	C034	Anne	Way	111 storrie Road, paisley
1334	2/08/00.13.00	I666	Karen	Black	C089	Mark	Fields	120 Lady Lane, paisley
1455	2/08/00.13.00	I957	Steven	Smith	C019	John	Brown	13 Renfrew Road paisley
1676	25/08/00.10.00	I344	Tom	Jones	C039	Karen	Worth	34 High Street, paisley

PK: driverID, ClientID

1NF

driverID	dFName	DLName
I456	Jane	Watt
I344	Tom	Jones
I666	Karen	Black
I957	Steven	Smith

PK: driverID

jobID	pickupDateTime	ClientID	cLName	cLName	CAddress	driverID
1001	25/07/00.10.10	C034	Anne	Way	111 storrie Road, paisley	I456
1001	29/07/00.10.00	C034	Anne	Way	111 storrie Road, paisley	I456
1203	30/07/00.11.00	C034	Anne	Way	111 storrie Road, paisley	I344
1334	2/08/00.13.00	C089	Mark	Fields	120 Lady Lane, paisley	I666
1455	2/08/00.13.00	C019	John	Brown	13 Renfrew Road paisley	I957
1676	25/08/00.10.00	C039	Karen	Worth	34 High Street, paisley	I344

PK: ClientID

FK: driverID

2NF

driverID	dFName	DLName
I456	Jane	Watt
I344	Tom	Jones
I666	Karen	Black
I957	Steven	Smith

PK: driverID

jobID	pickupDateTime	ClientID	driverID
1001	25/07/00.10.10	C034	I456
1001	29/07/00.10.00	C034	I456
1203	30/07/00.11.00	C034	I344
1334	2/08/00.13.00	C089	I666
1455	2/08/00.13.00	C019	I957
1676	25/08/00.10.00	C039	I344

PK: JobID

FK: driverID, ClientID

ClientID	cLName	cLName	CAddress
C034	Anne	Way	111 storrie Road, paisley
C089	Mark	Fields	120 Lady Lane, paisley
C019	John	Brown	13 Renfrew Road paisley
C039	Karen	Worth	34 High Street, paisley

PK: ClientID

3NF

driverID	dFName	DLName
I456	Jane	Watt
I344	Tom	Jones
I666	Karen	Black
I957	Steven	Smith

Entity: Drivers

PK: driverID

jobID	ClientID	driverID
1001	C034	I456
1001	C034	I456
1203	C034	I344
1334	C089	I666
1455	C019	I957
1676	C039	I344

Entity: JobList

FK: driverID, ClientID, JobID

ClientID	cLName	cLName	CAddress
C034	Anne	Way	111 storrie Road, paisley
C089	Mark	Fields	120 Lady Lane, paisley
C019	John	Brown	13 Renfrew Road paisley
C039	Karen	Worth	34 High Street, paisley

Entity: Cleints

PK: ClientID

jobID	pickupDateTime
1001	25/07/00.10.10
1001	29/07/00.10.00
1203	30/07/00.11.00
1334	2/08/00.13.00
1455	2/08/00.13.00
1676	25/08/00.10.00

Entity: Jobs

PK: jobID