

Database Systems

Normalization & Functional Dependencies

Total: 100 points

Q1. (45 points)

Assume that the following tables (raw data) is provided to you. Have a good look at the data and then based on the data given and your understanding of functional dependency, multi-value dependency and normalization answer the following questions for each of the following tables (i) and (ii):

- Draw a dependency diagram. Indicate any and all functional dependencies and multi-value dependencies on your diagram.
- Which normal form is the table in? (write assumptions)
- Normalize it further up to 3NF wherever possible. Show your successive normalization steps. (write assumptions)

PET ID	PET NAME	PET TYPE	PET AGE	OWNER	VISIT DATE	PROCEDURE
246	ROVER	DOG	12	SAM COOK	JAN 13/2002 MAR 27/2002 APR 02/2002	01 - RABIES VACCINATION 10 - EXAMINE and TREAT WOUND 05 - HEART WORM TEST
298	SPOT	DOG	2	TERRY KIM	JAN 21/2002 MAR 10/2002	08 - TETANUS VACCINATION 05 - HEART WORM TEST
341	MORRIS	CAT	4	SAM COOK	JAN 23/2001 JAN 13/2002	01 - RABIES VACCINATION 01 - RABIES VACCINATION
519	TWEEDY	BIRD	2	TERRY KIM	APR 30/2002 APR 30/2002	20 - ANNUAL CHECK UP 12 - EYE WASH

i.

PartNumber	Description	Supplier	SupplierAddress	Price
10010	20 GB Disk	Seagate	Cupertino, CA	\$100
10010	20 GB Disk	IBM	Armonk, NY	\$90
10220	256 MB RAM card	Kensington	San Mateo, CA	\$220
10220	256 MB RAM card	IBM	Armonk, NY	\$290
10220	256 MB RAM card	Sun Microsystems	Palo Alto, CA	\$310
10440	17" LCD Monitor	IBM	Armonk, NY	\$2,100

ii.

Q2. (30 points)

Consider the following relation: (populate it with some mock-up data)

CAR_SALE(Car#, Date_sold, Salesperson#, Commission%, Discount_amt)

Assume that a car may be sold by multiple salespeople, and hence $\{\text{'Car\#', Salesperson\#'}\}$ must be unique for every tuple in the given relation 'CAR_SALE'. Each car ('Car#') is sold only once and that too on a date as recorded by the attribute 'Date_sold'. Additional dependencies are

$\text{Date_sold} \rightarrow \text{Discount_amt}$

$\text{Salesperson\#} \rightarrow \text{Commission\%}$

Based on the above information, is this relation in 1NF, 2NF, or 3NF? Why or why not? If not then show that how would you successively normalize it completely (upto 3NF)? You would be required to make one or more reasonable assumptions in the given schema for the dependencies, include them in your solution.

Q3. (25 points)

Consider the following relation:

TRIP (Trip_id, Start_date, Cities_visited, Cards_used)

This relation refers to business trips made by company salespeople. Suppose the TRIP has a single Start_date but involves many Cities and salespeople may use multiple credit cards on the trip. Make up and include a mock-up population of the table.

- a. Discuss what FDs (Functional Dependencies) and/or MVDs (Multi-value Dependencies) exist in this relation.
- b. Show how you will go about normalizing the relation upto highest possible normal form (4 NF if possible).