

Members(member_ID, first_name, last_name)
Profiles(member_ID, profile_name)
Movie(movie_ID, title, movie_year, producer, avg_rating)
Actor(actor_ID, first_name, last_name)
Starred_By(movie_ID, actor_ID)
Watch(member_ID, profile_name, movie_ID, rating)

Problem 1

A: (12 points) list all non-trivial FDs in the relation

(Member_ID) \rightarrow (first_name, last_name)
(Movie_ID) \rightarrow (title, movie_year, producer, avg_rating)
(Actor_ID) \rightarrow (first_name, last_name)
(Member_ID, Profile_name, Movie_ID) \rightarrow Rating

B: (12 points) determine if the relation is in BCNF

Members : BCNF

Profiles: BCNF

Movie: BCNF

Actor: BCNF

Starred_by: BCNF

Watch: BCNF

C: (12 points) if the relation is not in BCNF, decompose it into a set of BCNF relations, else just state that it's already in BCNF.

Everything is already in BCNF

D: (6 points) If we want to add credit card information for the members (credit card number, name on the credit card, and expiration date), what are the answers for (a)-(c)? Assume a credit card can be used by different members.

Members(member_ID, first_name, last_name, credit_card_num, name_on_card, exp_date)

A

(Member_ID) \rightarrow (First_name, Last_name, Credit_card_num, Name_on_card, exp_date)

(Credit_card_num) \rightarrow (Name on card, exp date)

B

No

C.

Break into:

Members(Member_ID, first_name, last_name, credit_card_num)

Ccinfo(Credit_card_num, name_on_card, exp_date)

Problem 2: Consider the following relation:

CAR_SALE(Car_id, Salesman_id, Date_sold, Commision_percent, Discount_amt)

Assume that a car may be sold by multiple salesmen and hence {Car_id, Salesman_id} is the primary key. Additional dependencies are:

Date_sold \rightarrow Discount_amt

Salesman_id \rightarrow Commission_percent

Car_id \rightarrow Date_sold

(1) (35 points) Based on the given primary key and the FDs, answer whether this relation is in the following normal forms. Explain why or why not. Note this is not a multiple-choice question. You must answer each question separately.

a. 1NF

Yes, no duplicate lines, each cell unique entry

b. 2NF

No. Commission_percent is only dependant on salesman_id(partial dependency). Also partially dependant in regards to Date_sold

c. BCNF

No. Discount_amt is not dependant on a superkey

d. 3NF

No. transitive dependency Car_id \rightarrow Date_sold \rightarrow Discount_amt exists

(2) (35 points) Continuing from the last question, if the relation is not in the specific normal form, discuss how you normalize it to that normal form. If it's already in the specific normal form, just answer "It's already in XXX" (replace XXX with "1NF", "2NF", "BCNF" or "3NF").

a. 1NF

Already in 1NF

b. 2NF

Break into tables:

CAR_SALE(Car_id, Date_sold,Discount_Amt)

Commissions(Salesman_ID,Commision_percent)

Sellers(Car_ID,Salesman_ID)

Now there's no partial dependencies

c. BCNF

Note: If this is done in order: 1NF, 2NF, 3NF, BCNF then by the time we check BCNF we're already in BCNF. This was not the way the homework is written so I'm making no assumptions. Do B and D. By breaking the transitive discount_amt away from the relation, we're now in BCNF since we're in 3NF and everything is based on the superkey.

CarSold(Car_ID, Date_Sold)

DailyDiscount(Date_sold,Discount_amt)

Commissions(Salesman_ID,Commision_percent)

Sellers(Car_ID,Salesman_ID)

d. 3NF

Do B and:

Break CAR_SALE(Car_id, Date_sold,Discount_Amt) into

CarSold(Car_ID, Date_Sold)

DailyDiscount(Date_sold,Discount_amt)

Solves the transitive dependency