Normalization Tasks and Solutions – 01

11 Nov 2020 / Dr. Mahammad Sharifov

TASK-1: Normalize below given table to proper schema (up to 2NF)

staffNo	name	position	salary	branchNo	branchAddress	telNo
S1500	*Tom Daniels*	*manager*	*46000*	*B001*	*8 Jefferson, Portland, OR 97201*	*503-555-3618*
S0003	*Sally Adams*	*assistant*	*30000*	*B001*	*8 Jefferson, Portland, OR 97201*	*503-555-3618*
S0010	*Mary Martinez*	*manager*	*50000*	*B002*	*City Center, Seattle, WA 98122*	*206-555-6756*
S3250	*Robert Chin*	*supervisor*	*32000*	*B002*	*City Center, Seattle, WA 98122*	*206-555-6756*
S2250	*Sally Stern*	*manager*	*48000*	*B004*	*16th Avenue, Seattle, WA 98128*	*205-555-3131*
S0415	*Art Peters*	*manager*	*41000*	*B003*	*14th Avenue, New York, NY 1001*	*212-371-3000*

Problem:

StaffBranch table has redundant data; **the details of a branch** are repeated for every member of staff for example row 1 and 2, row 3 and 4 on *branchNo*, *branchAddress* and *telNo*.

Solution:

The branch information appears only once for each branch in the **Branch** table and only the branch number (*branchNo*) is repeated in the **Staff** table, to represent where each member of staff is located.

Staff Table

staffNo	name	position	salary	branchNo
S1500	*Tom Daniels*	*manager*	*46000*	*B001*
S0003	*Sally Adams*	*assistant*	*30000*	*B001*
S0010	*Mary Martinez*	*manager*	*50000*	*B002*
S3250	*Robert Chin*	*supervisor*	*32000*	*B002*
S2250	*Sally Stern*	*manager*	*48000*	*B004*
S0415	*Art Peters*	*manager*	*41000*	*B003*

Branch Table

branchNo	branchAddress	telNo
B001	*8 Jefferson, Portland, OR 97201*	*503-555-3618*
B002	*City Center, Seattle, WA 98122*	*206-555-6756*
B004	*16th Avenue, Seattle, WA 98128*	*205-555-3131*
B003	*14th Avenue, New York, NY 1001*	*212-371-3000*

TASK-2: Normalize below given table to proper schema

branchNo	branchAddress	telNos
B001	*8 Jefferson, Portland, OR 97201*	*503-555-3618, 505-555-2727, 303-555-3333*
B002	*City Center, Seattle, WA 98122*	*206-555-6756, 202-222-3344*
B004	*16th Avenue, Seattle, WA 98128*	*205-555-3131*
B003	*14th Avenue, New York, NY 1001*	*212-371-3000, 404-222-3435*

Problem:

Records in *telNos* columns are not single, they are multi. So, it is violating 1NF rules.

Solution:

Remove *telNos* column and create new column called *telNo* in the new table.

Branch (1NF)

branchNo	branchAddress
B001	*8 Jefferson, Portland, OR 97201*
B002	*City Center, Seattle, WA 98122*
B004	*16th Avenue, Seattle, WA 98128*
B003	*14th Avenue, New York, NY 1001*

BranchTelephone (1NF)

branchNo	telNo
B001	*503-555-3618*
B001	*505-555-2727*
B001	*303-555-3333*
B002	*206-555-6756*
B002	*202-222-3344*
B003	*205-555-3131*
B004	*212-371-3000*
B004	*404-222-3435*

TASK-3:

1. Why is this table not in 2NF?

2. Describe and illustrate the process of normalizing the data shown in this table to third normal form (3NF).

3. Identify the primary, (alternate) and foreign keys in your 3NF relations

staffNo	branchNo	branchAddress	name	position	hoursPerWeek
S4555	*B002*	*8 Jefferson, Portland, OR 97201*	*Ellen Layman*	*assistant*	*16*
S4555	*B004*	*City Center, Seattle, WA 98122*	*Ellen Layman*	*assistant*	*9*
S4612	*B002*	*8 Jefferson, Portland, OR 97201*	*Dave Sinclair*	*assistant*	*14*
S4612	*B004*	*City Center, Seattle, WA 98122*	*Dave Sinclair*	*assistant*	*10*

Problem:

- *staffNo* and *branchNo* columns together forms composite primary key.
- Values in *branchAddress* column can be worked out from only *branchNo*, so table not in 2NF
- Values in *name* and *position* columns can be worked out from only *staffNo*, so table not in 2NF
- Values in *hoursPerWeek* column can only be worked out from *staffNo* and *branchNo*

Solution:

Branch table (2NF)

branchNo	branchAddress
B002	*8 Jefferson, Portland, OR 97201*
B004	*City Center, Seattle, WA 98122*

Staff table (2NF)

staffNo	name	position
S4555	*Ellen Layman*	*assistant*
S4612	*Dave Sinclair*	*assistant*

Working table (2NF)

staffNo	branchNo	hoursPerWeek
S4555	*B002*	*16*
S4555	*B004*	*9*
S4612	*B002*	*14*
S4612	*B004*	*10*

TASK-4:

1. Why is this table not in 3NF?

2. Describe and illustrate the process of normalizing the data shown in this table to third normal form (3NF).

3. Identify the primary, (alternate) and foreign keys in your 3NF relations

branchNo	branchAddress	telNo	mgrStaffNo	name
B001	*8 Jefferson Way, Portland, OR 97201*	*503-555-3618*	*S1500*	*Tom Daniels*
B002	*City Center Plaza, Seattle, WA 98122*	*206-555-6756*	*S0010*	*Mary Martinez*
B003	*14 – 8th Avenue, New York, NY 10012*	*212-371-3000*	*S0145*	*Art Peters*
B004	*16 – 14th Avenue, Seattle, WA 98128*	*206-555-3131*	*S2250*	*Sally Stern*

Problem:

- Values in *branchAddress*, *telNo*, *mgrStaffNo*, and name columns can be worked out from *branchNo (primary key)*
- Values in *name* column can also be worked out from *mgrStaffNo (non-primary-key column)*, so table not in 3NF

Solution:

Branch table (3NF)

branchNo	branchAddress	telNo	mgrStaffNo
B001	*8 Jefferson Way, Portland, OR 97201*	*503-555-3618*	*S1500*
B002	*City Center Plaza, Seattle, WA 98122*	*206-555-6756*	*S0010*
B003	*14 – 8th Avenue, New York, NY 10012*	*212-371-3000*	*S0145*
B004	*16 – 14th Avenue, Seattle, WA 98128*	*206-555-3131*	*S2250*

Manager table (3NF)

mgrStaffNo	name
S1500	*Tom Daniels*
S0010	*Mary Martinez*
S0145	*Art Peters*
S2250	*Sally Stern*

TASK – 5:

StudentID	*CourseID*	*CourseName*	*CreditHours*	*PassingGrade*	*StdMark*
S01234	*ITSE1100*	*Multimedia*	*6*	*D*	*60*
S01234	*ITNT1103*	*Hardware*	*5*	*C*	*70*
S01234	*ITDB1102*	*Database*	*5*	*C*	*50*
S01235	*ITSE1100*	*Multimedia*	*6*	*D*	*70*
S01235	*ITNT1103*	*Hardware*	*5*	*C*	*80*

Solution:

StudentCourse { StudID, CourseID, StudMark }
Course { CourseID, CourseName, CreditHours, PassingGrade }

CourseID	*CourseName*	*CreditHours*	*PassingGrade*
ITSE1100	*Multimedia*	*6*	*D*
ITNT1103	*Hardware*	*5*	*C*
ITDB1102	*Database*	*5*	*C*

StudentID	*CourseID*	*StdMark*
S01234	*ITSE1100*	*60*
S01234	*ITNT1103*	*70*
S01234	*ITDB1102*	*50*
S01235	*ITSE1100*	*70*
S01235	*ITNT1103*	*80*

TASK – 6:

Stud ID	*Firstname*	*Lastname*	*Marital Status*	*Course Title*	*Fee*	*Qualfication*	*Grade*
1	*Kevin*	*Drum*	*Single*	*Computer Science*	*2000*	*Advanced level*	*A*
1	*Kevin*	*Drum*	*Single*	*Mathematics*	*1500*	*Advanced level*	*B*
1	*Kevin*	*Drum*	*Single*	*Physics*	*1800*	*Advanced level*	*C*
2	*Murvin*	*Drake*	*Single*	*Physics*	*1800*	*Advanced level*	*B*
2	*Murvin*	*Drake*	*Single*	*Chemistry*	*1800*	*Advanced level*	*C*
3	*John*	*Johnson*	*Single*	*Music*	*1200*	*Diploma*	*C*
4	*Sally*	*Jones*	*Single*	*Biology*	*1000*	*Certificate*	*A*
4	*Sally*	*Jones*	*Single*	*Economics*	*1500*	*Diploma*	*B*
5	*David*	*Smith*	*Married*	*Mathematics*	*2500*	*Advanced level*	*C*

5	*David*	*Smith*	*Married*	*Physics*	*1800*	*Advanced level*	*D*