

## CS3402 Tutorial 4:

1. Examine the table shown below.

**Branch**

Branch No	BranchAddress	TelNo
B001	8 Jefferson Way, Portland, OR 97201	503-555-3618, 503-555-2727, 503-555-6534
B002	City Center Plaza, Seattle, WA 98122	206-555-6756, 206-555-8836
B003	14 – 8th Avenue, New York, NY 10012	212-371-3000
B004	16 – 14th Avenue, Seattle, WA 98128	206-555-3131, 206-555-4112

- (a) Why is this table not in 1NF?
- (b) Describe and illustrate the process of normalizing the data shown in this table to third normal form (3NF).

**Answer:**

- (a) *TelNo* is not an attribute with atomic values, but with multi-values. So, the table is NOT in 1NF.
- (b) Create another relation specifically for *TelNo* with *BranchNo* as a foreign key

**Branch**

<u>BranchNo</u>	BranchAddress
B001	8 Jefferson Way, Portland, OR 97201
B002	City Center Plaza, Seattle, WA 98122
B003	14 – 8th Avenue, New York, NY 10012
B004	16 – 14th Avenue, Seattle, WA 98128

**BranchTel**

<u>BranchNo</u>	<u>TelNo</u>
B001	503-555-3618
B001	503-555-2727
B001	503-555-6534
B002	206-555-6756
B002	206-555-8836
B003	212-371-3000
B004	206-555-3131
B004	206-555-4112

2. Examine the table shown below.

**StaffBranchAllocation**

StaffNo	BranchNo	BranchAddress	Name	Position	HoursPer Week
S4555	B002	City Center Plaza, Seattle, WA 98122	Ellen Layman	Assistant	16
S4555	B004	16 – 14th Avenue, Seattle, WA 98128	Ellen Layman	Assistant	9
S4612	B002	City Center Plaza, Seattle, WA 98122	Dave Sinclair	Assistant	14
S4612	B004	16 – 14th Avenue, Seattle, WA 98128	Dave Sinclair	Assistant	10

<StaffNo, BranchNo> is the primary key.

<StaffNo> -> <Name, Position>; <BranchNo> -> <BranchAddress>

(a) Why is this table not in 2NF?

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

**Answer:**

(a) The primary key of StaffBranchAllocation table is <StaffNo, BranchNo>. There exist the partial functional dependencies: *StaffNo* → *Name, Position* and *BranchNo* → *BranchAddress*. The non-key attributes are not fully dependent on the key. So, the table is NOT in 2NF.

(b) Remove *BranchAddress, Name, Position* from StaffBranchAllocation relation to capture the partial functional dependencies separately.

### Branch

<u>BranchNo</u>	BranchAddress
B002	City Center Plaza, Seattle, WA 98122
B004	16 – 14th Avenue, Seattle, WA 98128

### Staff

<u>StaffNo</u>	Name	Position
S4555	Ellen Layman	Assistant
S4612	Dave Sinclair	Assistant

### StaffBranchAllocation

<u>StaffNo</u>	<u>BranchNo</u>	HoursPerWeek
S4555	B002	16
S4555	B004	9
S4612	B002	14
S4612	B004	10

3. Examine the table shown below.

**BranchManager**

BranchNo	BranchAddress	TelNo	MgrStaffNo	MgrName
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

<BranchNo> is the primary key; <MgrStaffNo> -> <MgrName>

(a) Why is this table not in 3NF?

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

1. **Answer:**

(a) There exists a non-key attribute transitively dependent on the key, i.e., *MgrName* depends on *MgrStaffNo* and *MgrStaffNo* depends on *BranchNo*.

(b) Create another relation which specifically captures the dependency  
*MgrStaffNo* → *MgrName*

**Branch**

<u>BranchNo</u>	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

**ManagerStaff**

<u>MgrStaffNo</u>	MgrName
S1500	Tom Daniels
S0010	Mary Martinez
S0145	Art Peters
S2250	Sally Stern

4. Examine the table shown below and the set of functional dependency on its attributes:

**CourseRmAlloc** (CourseId, CourseName, Year, Lecturer, Enrollment, RoomId, RoomCapacity, Day, Time)

FD = { *CourseId* -> *CourseName*,      *CourseName* -> *CourseId*,  
           *CourseId*, *Year* -> *Lecturer*,      *CourseId*, *Year* -> *Enrollment*,  
           *RoomId* -> *RoomCapacity*,      *RoomId*, *Year*, *Day*, *Time* -> *CourseId*,

*CourseId, Year, Day, Time -> RoomId }*

- (a) Find all candidate keys of this table.
- (b) Decompose this table into relations that satisfy BCNF.

**Answer:**

- (a) There are three candidate keys in this table:
  - (Year, Day, Time, CourseId)
  - (Year, Day, Time, CourseName)
  - (Year, Day, Time, RoomId)
- (b) This table can be decomposed into the following in BCNF (so also in 3NF):
  - CourseTeaching** (CourseId, Year, Lecturer, Enrollment)
  - Room** (RoomId, RoomCapacity)
  - CourseRoomAlloc** (CourseName, Year, Day, Time, RoomId)
  - Course** (CourseName, CourseId)