CS3402 Practice 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 this table is 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

BranchNo	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

BranchNo	TelNo
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 this table is 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

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

Staff

StaffNo	Name	Position
S4555	Ellen Layman	Assistant
S4612	Dave Sinclair	Assistant

StaffBranchAllocation

StaffNo	BranchNo	HoursPerWeek
S4555	B002	16
S4555	B004	9
S4612	B002	14
S4612	B004	10

3. Examine the table shown below.

BranchManager

Branch No	BranchAddress	TelNo	MgrStaff No	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 this table is 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

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

ManagerStaff

MgrStaffNo	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 a design into 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 (CourseId, Year, Day, Time, RoomId)
Course (CourseId, CourseName)