# Q3. 25 points) Normalize the following relation to the 3NF

Faculty (Number, Name, Dorm, RoomType, DormCost, Club, ClubCost, Sibling, Nickname)

**Number: Primary Key**

RoomType 🡪 DormCost

Number🡪 Name

Dorm 🡪 Number

Number 🡪 RoomType

Club 🡪 ClubCost

Number 🡪 Club

The following two FDs are multi-valued

Number 🡪> Sibling

Number 🡪> Nickname

Put Into Letters

Faculty (Number, Name, Dorm, RoomType, DormCost, Club, ClubCost, Sibling, Nickname)

Number =A || Name = B|| Dorm =C|| RoomType=D || DormCost = E|| Club=F|| ClubCost=G|| Sibling=H|| Nickname=I

D🡪E

A🡪B

C🡪A

A🡪D

F🡪G

A🡪F

A🡪H

A🡪I

E🡪 A🡪B,D,F,H,I

|

G

Is the table in 1NF?

The table is NOT in 1NF because we have two attributes that are multi-valued. We will need to break the table.

SiblingNo🡪Sname || This then becomes H🡪J

NicknameNo🡪Nickname || This then Becomes I🡪K

This is now in 1NF

C🡪 A🡪B,D,F,H,I

| | | |

E G J K

2NF: All the non-key attributes are fully dependent on the key, therefore it is not in 2NF and the table needs to be broken.

C🡪 A🡪B,D,F,H,I

| | | |

E G J K

C is not dependent on A, which is the primary key, thus the table needs to be split.

R1=(CA) R2=(ABDEFGHIJK) R1 & R2 are now in 2NF. This is lossless and the FD’s hold.

C becomes a Primary Key and A is a Foreign Key for R2. R1 does not suffer from transitivity, thus it is in 3NF.

R2,1=(ABDFHI) R2,2=(DFHIEGJK) This is lossless and the FDs hold, R2,1 does not suffer from transitivity, it is in 3NF. R2,2 suffers from not being in 2NF and needs to be broken.

R3,1=(DE) R4,1=(FG) R5,1(HJ) These tables are now in 3NF and 2NF, the FD’s hold R6,1(IK) and this is lossless.

Here are the tables that are in 3NF:

Table R1=(CA)

|  |  |
| --- | --- |
| Dorm | Number |

PK = Dorm

FK = Number

Table R2,1=(ABDFHI)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number | Name | RoomType | Club | Sibling | Nickname |

PK = Number

FK = Name, RoomType, Club, Sibling, Nickname

Table R3,1=(DE)

|  |  |
| --- | --- |
| RoomType | DormCost |

PK = RoomType

Table R4,1=(FG)

|  |  |
| --- | --- |
| Club | ClubCost |

PK = Club

Table R5,1(HJ)

|  |  |
| --- | --- |
| SiblingNo | SiblingName |

PK = Sibling

TableR6,1(IK)

|  |  |
| --- | --- |
| NicknameNo | Nickname |

PK = Nickname