44-560 ADVANCED TOPICS IN DB SYSTEMS  
Assignment - 02

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**Problem 1  
Convert the following relation to 2NF and then to 3NF. Show both conversions. Make sure to  
denote each foreign key directly beneath the relation that contains the foreign key.  
Relation: (Z, U, W, R, B, L, N, Q, D, A, H, O, F, S, V, X, E, J, M)**

**Functional Dependencies (FDs):**

**Z ->D, S N ->H U ->H B ->Q**

**W ->V L ->F Z ->S A ->Q**

**B ->X L ->E S ->J, M U ->O**

**B ->A E ->F D ->S O ->H**

**2NF**

R1= (**Z**, D ,S) , Z is FK in R7

R2=(**W**,V) , W is FK in R7

R3=(**B**,X,A,Q) , B is FK in R7

R4=(**N,**H), N is FK in R7

R5=(**L,**F,E), L is FK in R7

R6=( **U,**O), U is FK in R7

R7=( **Z,U,W,R,B,L,N**,J,M)

**3NF**

R1=(**E,**F) , E is FK in R9

R2=( **S,** J,M), S is FK in R3

R3=( **D,**S), D is FK in R6

R4=( **A,** Q), A is FK in R8

R5=( **O,**H), O is FK in R10

R6= (**Z**, D), Z is FK in R11

R7=(**W**,V), W is FK in R11

R8=(**B**,X,A), B is FK in R11

R9=(**L,**E), L is FK in R11

R10=( **U**,O), U is FK in R11

R11=( **Z,U,W,R,B,L,N**)

Problem 2

SALES (**Sales RepID** , Rep\_Name , Rep\_Address , Rep\_Rate)

CUSTOMER (**Customer\_ID** , Customer\_Name , Customer\_Address)

ORDER (**Order ID** , Order\_Date, Order\_Cost , **Sales RepID ,Customer\_ID**)

* FK Sales\_RepID -> SALES
* FK Customer\_ID -> CUSTOMER

ITEM (**Item\_ID** , Item\_Description , Cost\_Per\_Item)

ORDERITEM ( **Order ID** , **Item\_ID** , Num\_Ordered)

* PKFK1 Order\_ID -> ORDER
* PKFK2 Item\_ID -> ITEM

We mainly have Four entities here SALES , CUSTOMER , ORDER ,and ITEM with **Sales RepID** , **Customer\_ID** , **Order ID** , **Item\_ID**  as Primary Key respectively .

**Sales RepID ,Customer\_ID** are foreign keys in the table ORDER

The relation between the tables are as follows:

* Tables SALES and ORDER have a weak relation from SALES to ORDER the cardinality is optional many and the cardinality from ORDER to SALES is Mandatory one .
* Tables CUSTOMER and ORDER have a weak relation from CUSTOMER to ORDER the cardinality is optional many and the cardinality from ORDER to CUSTOMER is Mandatory one .
* Both ORDER and ITEM share many to many relation ship so we have a associative entity ORDERITEM in between ORDER and ITEM .
  + Tables ORDER and ORDERITEM have a Strong relation from ORDER to ORDERITEM the cardinality is Mandatory many and the cardinality from ORDERITEM to ORDER is Mandatory one .
  + Tables ITEM and ORDERITEM have a Strong relation from ITEM to ORDERITEM the cardinality is Mandatory many and the cardinality from ORDERITEM to ITEM is Mandatory one .