Exersise 3 solution

a) Explain three anomalies that can arise when working with table that is not in 3rd normal form.

Insert, Update, delete anomalies. Explain them with example

b) Convert the above table into 1st , 2nd and 3rd normal form.

Project Code	Project Name	Project Manager	Project Budget	Employee No.	Employee Name	Department No.	Department Name	Hourly Rate
PC010	Reservation System	Mr. Ajay	120500	S100	Mohan	D03	Database	21.00
PC010	Reservation System	Mr. Ajay	120500	S101	Vipul	D02	Testing	16.50
PC010	Reservation System	Mr. Ajay	120500	S102	Riyaz	D01	IT	22.00
PC011	HR System	Mrs. Charu	500500	S103	Pavan	D03	Database	18.50
PC011	HR System	Mrs. Charu	500500	S104	Jitendra	D02	Testing	17.00
PC011	HR System	Mrs. Charu	500500	S315	Pooja	D01	IT	23.50
PC012	Attendance System	Mr. Rajesh	710700	S137	Rahul	D03	Database	21.50
PC012	Attendance System	Mr. Rajesh	710700	S218	Avneesh	D02	Testing	15.50
PC012	Attendance System	Mr. Rajesh	710700	S109	Vikas	D01	IT	20.50

UNF

1- First Normal Form (1NF)

A database table is said to be in 1NF if it contains no repeating fields/columns. The process of converting the UNF table into 1NF is as follows:

1.Separate the repeating fields into new database tables along with the key from the unnormalized database table.
2.The primary key of new database tables may be a composite key.
1NF of the above UNF table is as follows:

Primary Key

Project Code	Project Name	Project Manager	Project Budget
PC010	Reservation System	Mr. Ajay	120500
PC011	HR System	Mrs. Charu	500500
PC012	Attendance System	Mr. Rajesh	710700

Composite Key (Unique Key)

Project Code	Employee No.	Employee Name	Department No.	Department Name	Hourly Rate
PC010	S100	Mohan	D03	Database	21.00
PC010	S101	Vipul	D02	Testing	16.50
PC010	S102	Riyaz	D01	IT	22.00
PC011	S103	Pavan	D03	Database	18.50
PC011	S104	Jitendra	D02	Testing	17.00
PC011	S315	Pooja	D01	IT	23.50
PC012	S137	Rahul	D03	Database	21.50
PC012	S218	Avneesh	D02	Testing	15.50
PC012	S109	Vikas	D01	IT	20.50

1NF

2- Second Normal Form (2NF)

A database table is said to be in 2NF if it is in 1NF and contains only those fields/columns that are functionally dependent(means the value of the field is determined by the value of another field(s)) on the primary key. In 2NF we remove the partial dependencies of any non-key field.

The process of converting the database table into 2NF is as follows:

1- Remove the partial dependencies(A type of functional dependency where a field is only functionally dependent on the part of the primary key) of any non-key field.
2- If field B depends on field A and vice versa. Also for a given value of B, we have only one possible value of A and vice versa, Then we put the field B into a new database table where B will be the primary key and also marked as a foreign key in a parent table.

2NF of the above 1NF tables is as follows:

Primary Key

Project Code	Project Name	Project Manager	Project Budget
PC010	Reservation System	Mr. Ajay	120500
PC011	HR System	Mrs. Charu	500500
PC012	Attendance System	Mr. Rajesh	710700

Composite Key

Project Code	Employee No.	Hourly Rate
PC010	S100	21.00
PC010	S101	16.50
PC010	S102	22.00
PC011	S103	18.50
PC011	S104	17.00
PC011	S315	23.50
PC012	S137	21.50
PC012	S218	15.50
PC012	S109	20.50

Primary Key

Employee No.	Employee Name	Department No.	Department Name
S100	Mohan	D03	Database
S101	Vipul	D02	Testing
S102	Riyaz	D01	IT
S103	Pavan	D03	Database
S104	Jitendra	D02	Testing
S315	Pooja	D01	IT
S137	Rahul	D03	Database
S218	Avneesh	D02	Testing
S109	Vikas	D01	IT

2NF

As you can see in the above example, We have divided our 1NF table into two tables viz. Table 1 and Table2. Where Table 1 contains project information. and Table 2 contains information on the employee assigned to the specific projects.

We have introduced a new column called project_code which is the primary key for table 1. Records can be uniquely identified in Table 1 using the project id column itself.

3- Third Normal Form (3NF)

A database table is said to be in 3NF if it is in 2NF and all non-keys fields should be dependent on the primary key We can also say a table to be in 3NF if it is in 2NF and no fields of the table are transitively functionally dependent on the primary key. The process of converting the table into 3NF is as follows:

1.Remove the transitive dependencies(A type of functional dependency where a field is functionally dependent on the Field that is not the primary key. Hence its value is determined, indirectly by the primary key).
2.Make a separate table for transitive dependent Fields.

3NF of the above 2NF tables is as follows:

Primary Key

Project Code	Project Name	Project Manager	Project Budget
PC010	Reservation System	Mr. Ajay	120500
PC011	HR System	Mrs. Charu	500500
PC012	Attendance System	Mr. Rajesh	710700

Composite Key

Project Code	Employee No.	Hourly Rate
PC010	S100	21.00
PC010	S101	16.50
PC010	S102	22.00
PC011	S103	18.50
PC011	S104	17.00
PC011	S315	23.50
PC012	S137	21.50
PC012	S218	15.50
PC012	S109	20.50

Primary Key

Employee No.	Employee Name	Department No.
S100	Mohan	D03
S101	Vipul	D02
S102	Riyaz	D01
S103	Pavan	D03
S104	Jitendra	D02
S315	Pooja	D01
S137	Rahul	D03
S218	Avneesh	D02
S109	Vikas	D01

Primary Key FK_Relationship

Department No.	Department Name
D01	IT
D02	Testing
D03	Database

3NF

Source: https://www.dotnettricks.com/learn/sqlserver/database-normalization-basics