

Second Normal Form

Second Normal Form (2NF)

- Based on the concept of full functional dependency.
- Recall, full functional dependency indicates that if A, B and C are attributes of a relation, and C is fully functionally dependent on the composition of A and B, then C is functionally dependent on A,B but not on any proper subset of A,B.

Second Normal Form (2NF)

- **A table is in second normal form (2NF) if and only if it is in 1NF and every non-key attribute is functionally dependent on the entire primary key and not just on a subset of the primary key (i.e. fully functionally dependent on the primary key).**

1NF to 2NF

- Identify the primary key for the 1NF relation.
- Identify the functional dependencies in the relation.
- If partial dependencies exist on the primary key remove them by placing them in a new relation along with a copy of their determinant.

1NF to 2NF

- The steps involved in transforming a table in first normal form into a set of second normal form tables are as follows:
 1. We must separate out the dependent attribute(s) and the determinant into a table of their own. The determinant becomes the primary key of this table.
 2. The determinant(s) remains as part of the composite key in the original table.

Example

- Consider the relation EmployeeProject below.

EmployeeProject(PPS, ProjCode, Hours, Name, Title)
Primary key PPS, ProjCode

| PPS | ProjCode | Hours | Name | Title |
|-----------|----------|-------|----------------|----------|
| 123456789 | ABC | 32.5 | Smith, John | Galaxy |
| 123456789 | PQR | 7.5 | Smith, John | Romeo |
| 333456781 | ABC | 20 | English, Joyce | Galaxy |
| 333456781 | XYZ | 14 | English, Joyce | Alpha |
| 333456781 | JKL | 6 | English, Joyce | Sapphire |
| 345123876 | PQR | 23 | Ryan, Melanie | Romeo |
| 345123876 | XYZ | 17 | Ryan, Melanie | Alpha |

EmployeeProject

Example

- $PPS, ProjCode \rightarrow Hours$ is a *full functional dependency* because neither $PPS \rightarrow Hours$ nor $ProjCode \rightarrow Hours$.
- However, $PPS \rightarrow Name$ and $ProjCode \rightarrow Title$.
Therefore, the non-key attributes (Name and Title) are partial key dependents.

Example

1. We must separate out the dependent attribute(s) and the determinant into a table of their own. The determinant becomes the primary key of this table.

Employee(PPS, Name)

Primary key PPS

Project(ProjCode, Title)

Primary key ProjCode

Example

2. The determinant(s) remains as part of the composite key in the original table.

EmployeeProject(PPS, ProjCode, Hours)

Primary key PPS, ProjCode

Foreign key PPS references Employee(PPS)

Foreign key ProjCode references Project(ProjCode)

Exercise

TempStaffAllocation(staffNo, dCenterNo, name,
position, hoursPerWeek)

Primary key staffNo, dCenterNo

TempStaffAllocation

| staffNo | dCenterNo | name | position | hoursPerWeek |
|---------|-----------|---------------|-----------|--------------|
| S4555 | D002 | Ellen Layman | Assistant | 16 |
| S4555 | D004 | Ellen Layman | Assistant | 9 |
| S4612 | D002 | Dave Sinclair | Assistant | 14 |
| S4612 | D004 | Dave Sinclair | Assistant | 10 |

Exercise

- The relation (TempStaffAllocation) is not in Second Normal Form
 - i. Why?
 - ii. Explain the steps involved in transforming the relation into Second Normal Form (2NF).
 - iii. Transform the relation into a set of Second Normal Form (2NF) relations.

Exercise
