

# Database Creation and Management

## Types of Normalization

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# Type of Normalization or Normal forms

- To overcome these anomalies we need to normalize the data.
- Here are the most commonly used normal forms:
  1. First normal form(1NF)
  2. Second normal form(2NF)
  3. Third normal form(3NF)
  4. Boyce-Codd normal form (BCNF)
  5. Fourth normal form (4NF)
  6. Fifth normal form (5NF)

# First normal form (1NF)

- An attribute (column) of a table cannot hold multiple values.
- It should hold only atomic values.
- A table in which the intersection of every column and record contains only one value.

# DistributionCenter table is not in 1NF

Primary key

**DistributionCenter**

dCenterNo	dAddress	dTelNos
D001	8 Jefferson Way, Portland, OR 97201	503-555-3618, 503-555-2727, 503-555-6534
D002	City Center Plaza, Seattle, WA 98122	206-555-6756, 206-555-8836
D003	14 – 8th Avenue, New York, NY 10012	212-371-3000
D004	2 W. El Camino, San Francisco, CA 94087	822-555-3131, 822-555-4112

More than one value, so *not* in 1NF



# Converting DistributionCenter table to 1NF

**DistributionCenter**

dCenterNo	dAddress	dTelNos
D001	8 Jefferson Way, Portland, OR 97201	503-555-3618, 503-555-2727, 503-555-6534
D002	City Center Plaza, Seattle, WA 98122	206-555-6756, 206-555-8836
D003	14 – 8th Avenue, New York, NY 10012	212-371-3000
D004	2 W. El Camino, San Francisco, CA 94087	822-555-3131, 822-555-4112

More than one value, so *not* in 1NF

Take copy of dCenterNo

Remove dTelNos column

Rename column dTelNo

**DistributionCenter**

dCenterNo	dAddress
D001	8 Jefferson Way, Portland, OR 97201
D002	City Center Plaza, Seattle, WA 98122
D003	14 – 8th Avenue, New York, NY 10012
D004	2 W. El Camino, San Francisco, CA 94087

Primary key

**DistributionCenterTelephone**

dCenterNo	dTelNo
D001	503-555-3618
D001	503-555-2727
D001	503-555-6534
D002	206-555-6756
D002	206-555-8836
D003	212-371-3000
D004	822-555-3131
D004	822-555-4112

Becomes foreign key

Becomes primary key

# Second normal form (2NF)

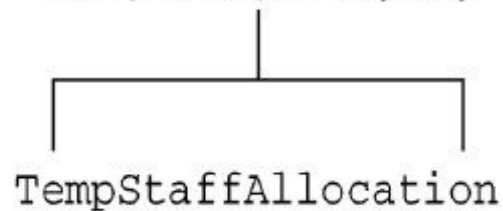
- It is based on the concept of *full functional dependency*.
- A relation schema  $R$  is in 2NF if every nonprime attribute  $A$  in  $R$  is *fully functionally dependent* on the primary key of  $R$ .
- An attribute of relation schema  $R$  is called a **prime attribute** of  $R$  if it is a member of *some candidate key* of  $R$  and if it is not a prime attribute then called as **nonprime** i.e. if it is not a member of any candidate key.

# Cont...

- If we follow 2NF, then every non-prime attribute should be fully functionally dependent on prime key attribute. That is, if  $X \rightarrow A$  holds, then there should not be any proper subset  $Y$  of  $X$ , for which  $Y \rightarrow A$  also holds true.

# TempStaffAllocation table is not in 2NF

Composite primary key



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



(fd1) ← Values in hoursPerWeek column are determined by (staffNo, dCenterNo)



(fd2) ← Values in name and position columns are only determined by staffNo, so table *not* in 2NF. This is an example of a partial dependency.



# Converting TempStaffAllocation table to 2NF

Composite primary key

**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

Remove position column

Remove name column

Take copy of staffNo

**TempStaffAllocation**

staffNo	dCenterNo	hoursPerWeek
S4555	D002	16
S4555	D004	9
S4612	D002	14
S4612	D004	10

Becomes foreign key

Composite primary key

(fd1)

**TempStaff**

staffNo	name	position
S4555	Ellen Layman	Assistant
S4612	Dave Sinclair	Assistant

Becomes primary key

(fd2)