
Week 11, Lec #21

Database Systems -

Introduction to Databases and Data Warehouses

CHAPTER 4 - Update Operations, Update Anomalies, and Normalization (Part 1)

MAIN TOPICS

- Update Operations
- Update Anomalies
- Functional Dependencies
 - Notation and Example 1

Chapter at a glance

- **Update operations**
 - Insert, delete, update
- **Redundant data**
 - **Multiple instances** of data referring to **same occurrence**
 - E.g. duplicate rows in one table
- **Update anomalies**
 - **Unexpected consequences caused by** updating operations on relations that contain **unnecessarily redundant** data
- **Normalization**
 - Process to **improve the design** of relational databases in order to **eliminate unnecessarily redundant** data

UPDATE OPERATIONS

- **Also called Write operations**
- **Insert operation**
 - Used for entering new data in the relation
- **Delete operation**
 - Used for removing existing data from the relation
- **Modify operation**
 - Used for changing the existing data in the relation

UPDATE OPERATIONS

Example of an **insert** operation

Before Insert

EMPLOYEE

<u>EmpID</u>	EmpName	Salary
1234	Becky	\$75,000
2345	Molly	\$50,000
3456	Rob	\$55,000

After Insert

Inserting a record

EMPLOYEE

<u>EmpID</u>	EmpName	Salary
1234	Becky	\$75,000
2345	Molly	\$50,000
3456	Rob	\$55,000
1324	Ted	\$70,000

UPDATE OPERATIONS

Example of a **delete** operation

Before Delete

EMPLOYEE

<u>EmpID</u>	EmpName	Salary
1234	Becky	\$75,000
2345	Molly	\$50,000
3456	Rob	\$55,000

Deleting a record

After Delete

EMPLOYEE

<u>EmpID</u>	EmpName	Salary
1234	Becky	\$75,000
3456	Rob	\$55,000

UPDATE OPERATIONS

Example of a **modification** operation

Before Modification

EMPLOYEE


<u>EmpID</u>	EmpName	Salary
1234	Becky	\$75,000
2345	Molly	\$50,000
3456	Rob	\$55,000

After Modification

EMPLOYEE

<u>EmpID</u>	EmpName	Salary
1234	Becky	\$75,000
2345	Molly	\$60,000
3456	Rob	\$55,000

Modifying a record



UPDATE OPERATIONS

Update operation terminology note:

- In practice, two different uses of the term “update operation”:
 - A) Update operation as a *collective term for insert, delete and modify operations*
 - B) Update operation as a *synonym for the modify operation*
- In this chapter,
 - Use the term update operation as defined in A)

UPDATE ANOMALIES

▪ Update anomalies

- Anomalies caused by update operations in relations that contain unnecessarily redundant (repeating) data
- Insertion anomaly
 - Occurs when inserting data about one real-world entity requires inserting data about another real-world entity
- Deletion anomaly
 - Occurs when deletion of data about a real-world entity forces deletion of data about another real-world entity
- Modification anomaly
 - Occurs when, in order to modify one real-world value, the same modification has to be made multiple times

UPDATE ANOMALIES

- Example: An Ad Agency data
 - The agency manages ad campaigns through a number of campaign modes.
 - Each campaign has a unique ID, a unique name, a start date, a duration, and a campaign manager who has a name and a unique ID.
 - Each campaign mode has a unique ID, uses a particular media (e.g. TV, Internet, etc) to cover a specific range (e.g. local, national, etc).
 - Each ad campaign can use a number of different campaign modes. Each mode gets a percentage of the total campaign budget.
 - Each campaign manager can manage multiple campaigns.

UPDATE ANOMALIES

- Example: An Ad Agency data
 - Use one relation to represent and store all campaigns and their managers and modes
 - All columns in this relation
 - AdCampaignID
 - AdCampaignName
 - StartDate
 - Duration
 - CampaignMgrID
 - CampaignMgrName
 - ModelID
 - Media
 - Range
 - BudgetPctg

Example: relation AD CAMPAIGN MIX

Sample Data:

AD CAMPAIGN MIX

<u>AdCampaignID</u>	AdCampaignName	StartDate	Duration	Campaign MgrID	Campaign MgrName	<u>ModelID</u>	Media	Range	BudgetPctg
111	SummerFun13	6.6.2013	12 days	CM100	Roberta	1	TV	Local	50%
111	SummerFun13	6.6.2013	12 days	CM100	Roberta	2	TV	National	50%
222	SummerZing13	6.8.2013	30 days	CM101	Sue	1	TV	Local	60%
222	SummerZing13	6.8.2013	30 days	CM101	Sue	3	Radio	Local	30%
222	SummerZing13	6.8.2013	30 days	CM101	Sue	5	Print	Local	10%
333	FallBall13	6.9.2013	12 days	CM102	John	3	Radio	Local	80%
333	FallBall13	6.9.2013	12 days	CM102	John	4	Radio	National	20%
444	AutmnStyle13	6.9.2013	5 days	CM103	Nancy	6	Print	National	100%
555	AutmnColors13	6.9.2013	3 days	CM100	Roberta	3	Radio	Local	100%

Example relation AD CAMPAIGN MIX

(contains redundant data)

AD CAMPAIGN MIX

<u>AdCampaignID</u>	AdCampaignName	StartDate	Duration	Campaign MgrID	Campaign MgrName	<u>ModelID</u>	Media	Range	BudgetPctg
111	SummerFun13	6.6.2013	12 days	CM100	Roberta	1	TV	Local	50%
111	SummerFun13	6.6.2013	12 days	CM100	Roberta	2	TV	National	50%
222	SummerZing13	6.8.2013	30 days	CM101	Sue	1	TV	Local	60%
222	SummerZing13	6.8.2013	30 days	CM101	Sue	3	Radio	Local	30%
222	SummerZing13	6.8.2013	30 days	CM101	Sue	5	Print	Local	10%
333	FallBall13	6.9.2013	12 days	CM102	John	3	Radio	Local	80%
333	FallBall13	6.9.2013	12 days	CM102	John	4	Radio	National	20%
444	AutmnStyle13	6.9.2013	5 days	CM103	Nancy	6	Print	National	100%
555	AutmnColors13	6.9.2013	3 days	CM100	Roberta	3	Radio	Local	100%

The media and range values for campaign mode 1 repeated twice

The name of the campaign manager CM100 repeated three times

The name, start date, and duration of the campaign 222 repeated three times

Examples of **update anomalies** in the relation AD CAMPAIGN MIX

AD CAMPAIGN MIX

<u>AdCampaignID</u>	AdCampaignName	StartDate	Duration	Campaign MgrID	Campaign MgrName	<u>ModelID</u>	Media	Range	BudgetPctg
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333	FallBall13	6.9.2013	12 days	CM102	John	4	Radio	National	20%
444	AutmnStyle13	6.9.2013	5 days	CM103	Nancy	6	Print	National	100%
555	AutmnColors13	6.9.2013	3 days	CM100	Roberta	3	Radio	Local	100%
????	????	????	????	????	????	7	Internet	National	????

Modification Anomaly Example:
To change the duration of the campaign
222 from 30 to 45 days, three records
have to be modified

Deletion Anomaly Example:
Cannot delete campaign 444 without also
deleting all the data about campaign
manager CM103 and campaign mode 6

Insertion Anomaly Example:
Cannot insert new campaign mode 7
without inserting an actual campaign
using the new mode 7

FUNCTIONAL DEPENDENCIES

- **Functional dependency**

- Occurs when the value of **one (or more) column(s)** in each record of a relation **uniquely determines** the value of **another column** in that **same record** of the relation
- Example - Relation CLIENT (ClientID, ClientName, ...)

- ClientID determines ClientName
- ClientName does NOT determine ClientID

CLIENT			
ClientID	ClientName	...	...
1001	William	...	...
2001	Matthew	...	...
3001	Lee	...	...
4001	Linda	...	...
5001	William	...	...

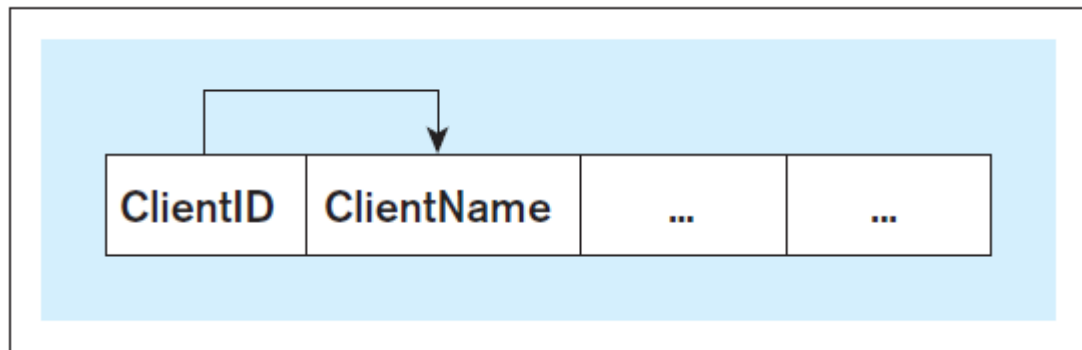
FUNCTIONAL DEPENDENCIES

- Two functional dependency notations
- Symbolic notation: ClientID determines ClientName

$A \rightarrow B$

ClientID \rightarrow ClientName

- Graphical notation: ClientID determines ClientName



Example: FDs of relation AD CAMPAIGN MIX

Sample Data:

AD CAMPAIGN MIX

<u>AdCampaignID</u>	AdCampaignName	StartDate	Duration	Campaign MgrID	Campaign MgrName	<u>ModelID</u>	Media	Range	BudgetPctg
111	SummerFun13	6.6.2013	12 days	CM100	Roberta	1	TV	Local	50%
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555	AutmnColors13	6.9.2013	3 days	CM100	Roberta	3	Radio	Local	100%

Identify the functional dependencies in the relation AD CAMPAIGN MIX.

FUNCTIONAL DEPENDENCIES

Example

- initially recognized sets of functional dependencies in relation AD CAMPAIGN MIX

Initially recognized sets of functional dependencies in the relation AD CAMPAIGN MIX

(Set 1) CampaignMgrID \rightarrow CampaignMgrName

(Set 2) ModelID \rightarrow Media, Range

(Set 3) AdCampaignID \rightarrow AdCampaignName, StartDate, Duration, CampaignMgrID,
CampaignMgrName

(Set 4) AdCampaignName \rightarrow AdCampaignID, StartDate, Duration, CampaignMgrID,
CampaignMgrName

(Set 5) AdCampaignID, ModelID \rightarrow AdCampaignName, StartDate, Duration, CampaignMgrID,
CampaignMgrName, Media, Range, BudgetPctg

(Set 6) AdCampaignName, ModelID \rightarrow AdCampaignID, StartDate, Duration, CampaignMgrID,
CampaignMgrName, Media, Range, BudgetPctg