Chapter VII
Functional Dependencies
&
Normalization

1. Relational Model

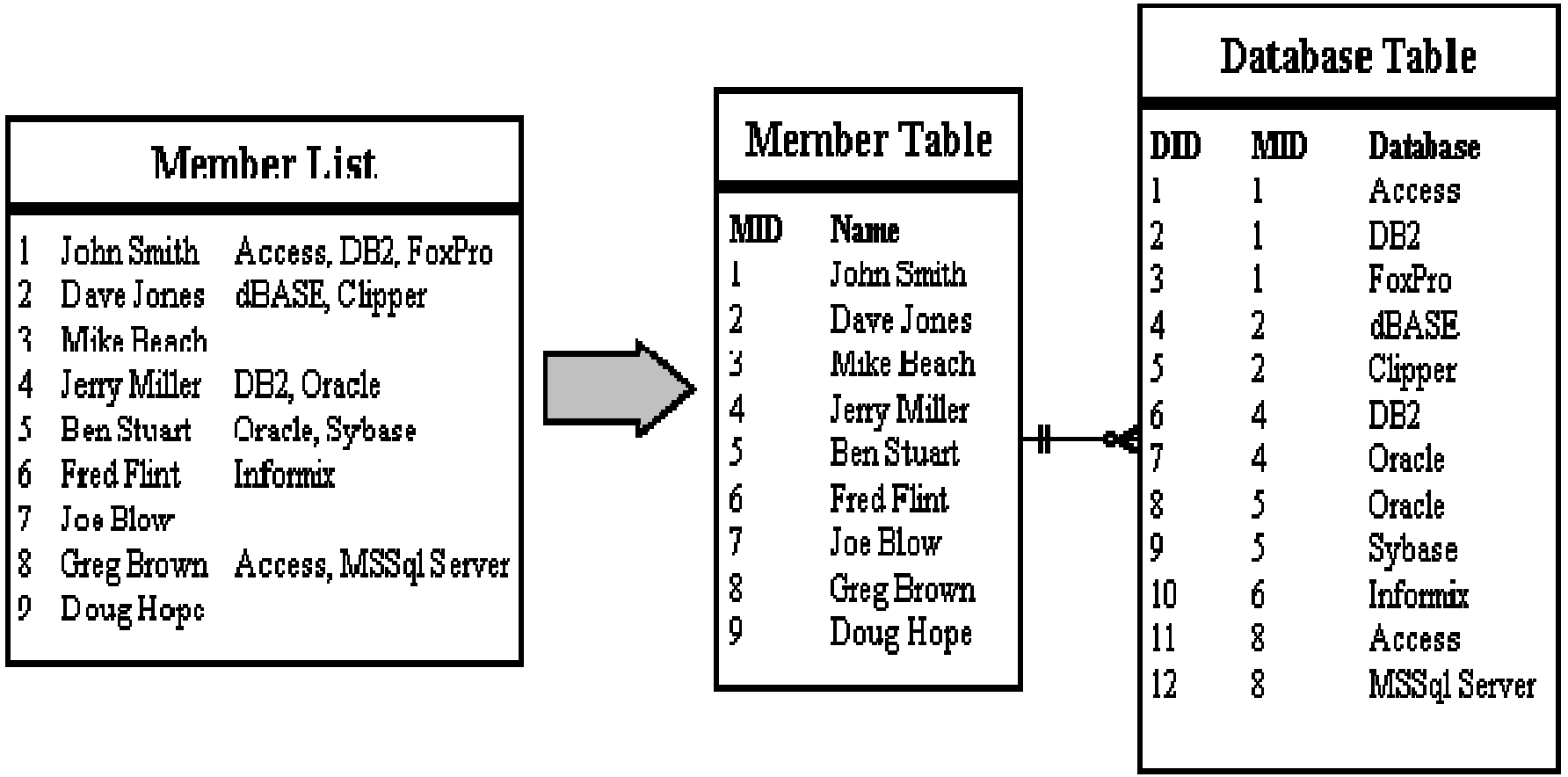
It is important for two reasons:

- It can be used to express DBMS independent database design
- It is the base of all DBMS products

Relation: A relation is a two-dimensional table with the following characteristics:

- The cells of the table must be of single value
- All of the entries in any column must be of the same kind
- Each column has a unique name
- No two rows in a table may be identical
- The orders of the columns and rows are insignificant

Example:


Member List
1 John Smith Access, DB2, FoxPro
2 Dave Jones dBASE, Clipper
3 Mike Beach
4 Jerry Miller DB2, Oracle
5 Ben Stuart Oracle, Sybase
6 Fred Flint Informix
7 Joe Blow
8 Greg Brown Access, MSSql Server
9 Doug Hope
Member Table
MID Name
1 John Smith
2 Dave Jones
3 Mike Beach
4 Jerry Miller
5 Ben Stuart
6 Fred Flint
7 Joe Blow
8 Greg Brown
9 Doug Hope
Database Table
DID MID Database
1 1 Access
2 1 DB2
3 1 FoxPro
4 2 dBASE
5 2 Clipper
6 4 DB2
7 4 Oracle
8 5 Oracle
9 5 Sybase
10 6 Informix
11 8 Access
12 8 MSSql Server

2. Functional Dependencies:

It is a relationship between or among attributes.

Example: if we know the value of CustomerAccountNumber, we can find the value of CustomerBalance. If this is true, we can say that CustomerBalance is ***functionally dependent*** on CustomerAccountNumber.

Example: Attribute Y is ***functionally dependent*** on attribute X if the value of X determines the value of Y.

If we know the value of X, we can obtain the value of Y.

X -> Y

X functionally determine Y

X determine Y

Y is dependent on X

X is called determinant

Functional Dependecy Characteristics:

1. If x - > Y then Y -> X is not guaranteed.
2. If X -> (Y,Z) then X->Y, and X -> Z.
3. If (X,Z) -> Y, then X -> Y and Z -> Y isnot guaranteed.

Example: The size problem and anomalies

fname	lmane	ssn	bdate	address	sex	salary	pnum	ploc	pname
Azad	Rasul	1433	1954	B-31-36	M	500	1	efraz	water
Naz	Ali	4354	1983	S-54-32	F	320	2	kirkuk	school
Kawa	Omer	3332	1967	A-32-6	M	450	3	erbil	highway
Dara	Nuri	8790	1974	B-43-21	M	400	1	efraz	water
……	…….	…….	……	……	……	……	……	……	…….
Shar	Karem	6543	1985	S-45-34	F	340	2	kirkuk	scholl

Modified Anomalies

- Insertion
- Deletion

3. Normalization

1st Normal Form: Any relation is in the 1NF

2nd Normal Form

Student

SID	Activity	Fee
100	Football	65
100	Golf	75
150	Swimming	50
175	Squash	45
175	Swimming	50
200	Swimming	50
200	golf	75

P.K (SID,Activity)

Activity -> Fee (partially dependency)

A relation is in **2NF** if all its non-key attributes are dependent on all of the key.

Student relation must decomposed into:

A(SID,Activity)

B(Activity, Fee)

3rd Normal Form

Student

SID	Building	Fee
100	RR	1200
150	GG	1100
200	RR	1200
250	PP	1100
300	RR	1200

Building -> Fee

SID -> Building -> Fee
(Transitive dependency)

A relation is in 3NF if it is in 2NF and has no transitive dependencies.

Relation Student must decomposed into:

A(SID, Building)

B(Building, Fee)

Boyce-Codd Normal Form

Advisor

SID	Major	Fname
100	Math	Azad
150	Psychology	Sheren
200	Math	Dara
250	Math	Azad
300	Psychology	Kawa
300	Math	Dara

P.K (SID, Major)

C.K(SID, Fname)

Fname -> Major

A relation is in **BCNF** if every determinant is a candidate key.

Advisor relation must decomposed into:

A(SID, Fname)

B(Fname, Subject)