IT 775
Database Technology

Relational Database (RD) Modeling

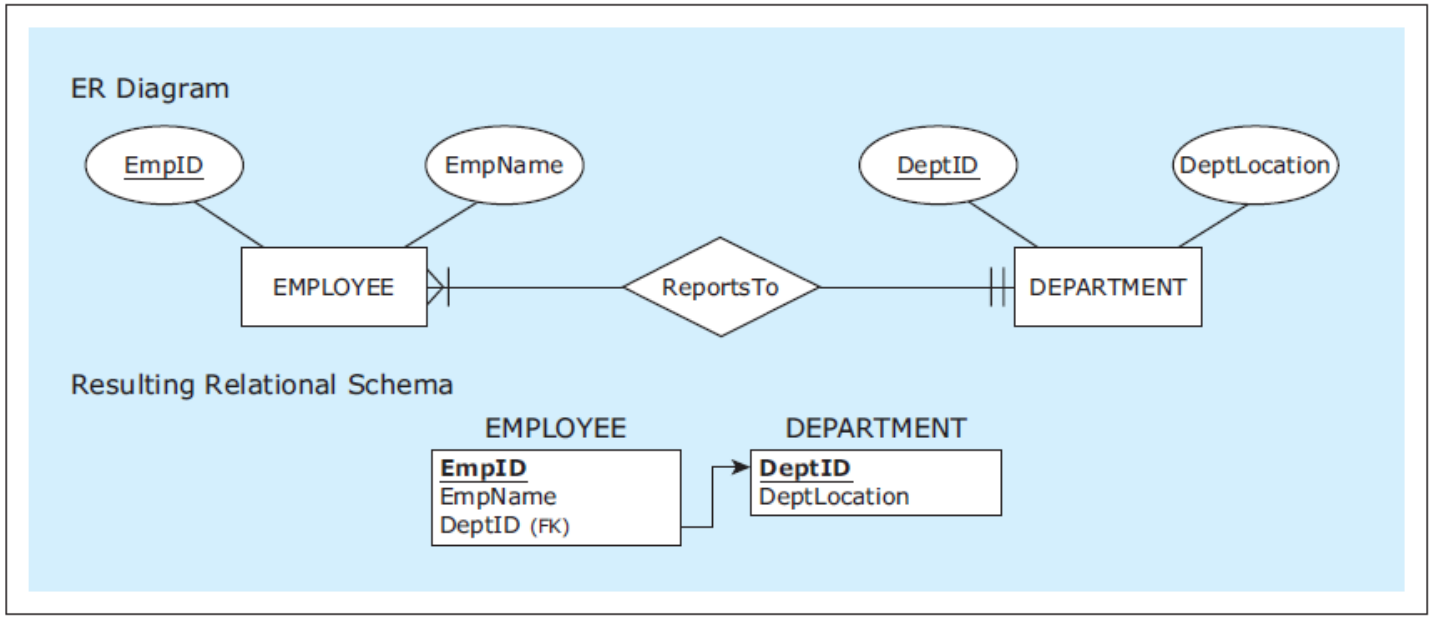
Relationship Mapping

FOREIGN KEY

- **Foreign key -** *column in a relation that refers to a primary key column in another (referred) relation*
  - A mechanism that is used to depict relationships in the relational database model
  - For every occurrence of a foreign key, the relational schema contains a line pointing *from* the *foreign key* to the *corresponding primary key*

Foreign Key Use Example

Example - Mapping a 1:M relationship



Sample data records for the mapped ER diagram

EMPLOYEE

EmpID	EmpName	DeptID
1234	Becky	1
2345	Molly	2
3456	Rob	1
1324	Ted	2

DEPARTMENT

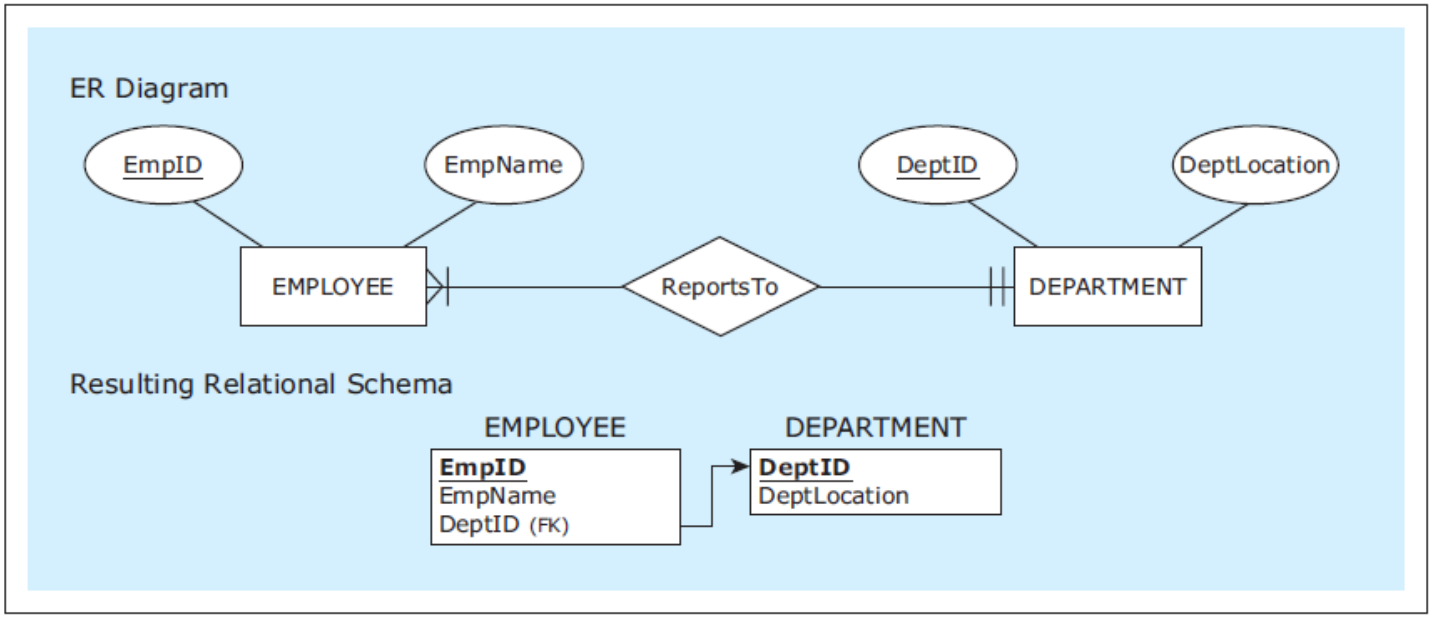
DeptID	DeptLocation
1	Suite A
2	Suite B

MAPPING RELATIONSHIPS

- **Mapping 1:M relationships**
  - *The relation mapped from the **entity on the M side** of the 1:M relationship **has a foreign key** that corresponds to the primary key of the relation mapped from the 1 side of the 1:M relationship.*

MAPPING RELATIONSHIPS

Example - Mapping a 1:M relationship



Sample data records for the mapped ER diagram

EMPLOYEE

EmpID	EmpName	DeptID
1234	Becky	1
2345	Molly	2
3456	Rob	1
1324	Ted	2

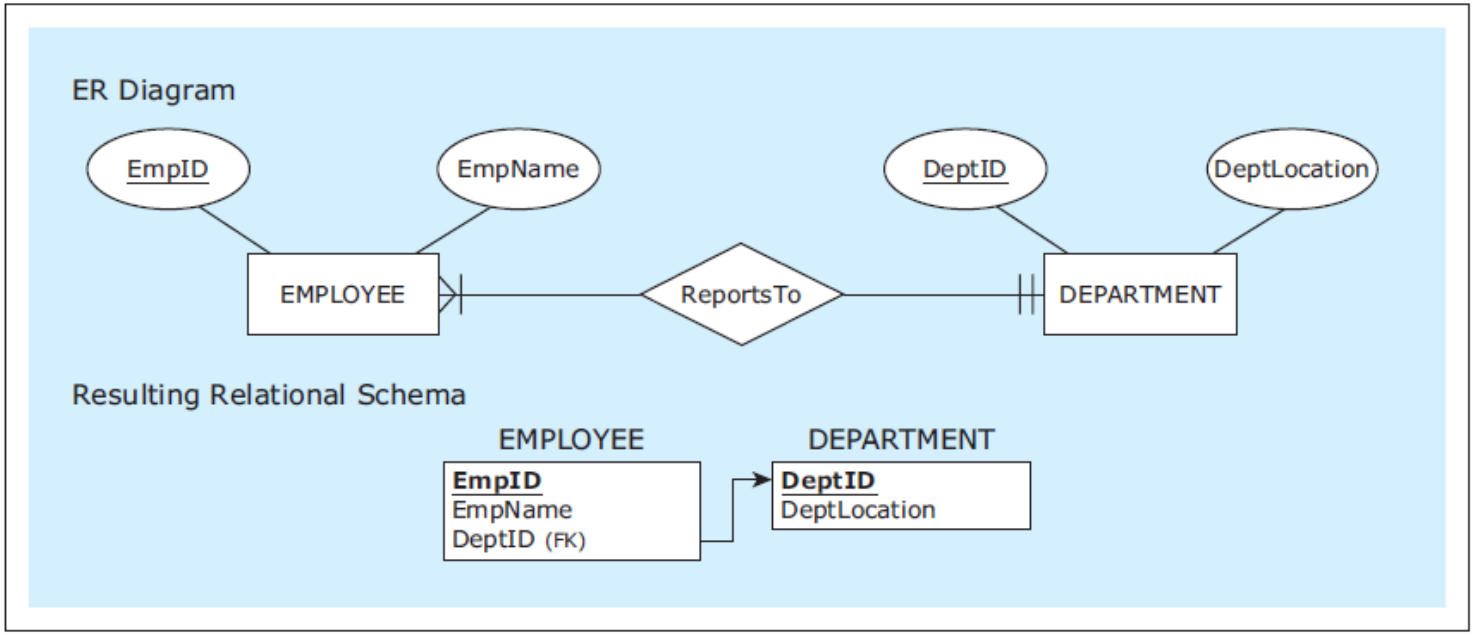
DEPARTMENT

DeptID	DeptLocation
1	Suite A
2	Suite B

MAPPING RELATIONSHIPS

Example - Mapping a 1:M relationship

Mandatory participation on both sides



Sample data records for the mapped ER diagram

EMPLOYEE

EmpID	EmpName	DeptID
1234	Becky	1
2345	Molly	2
3456	Rob	1
1324	Ted	2

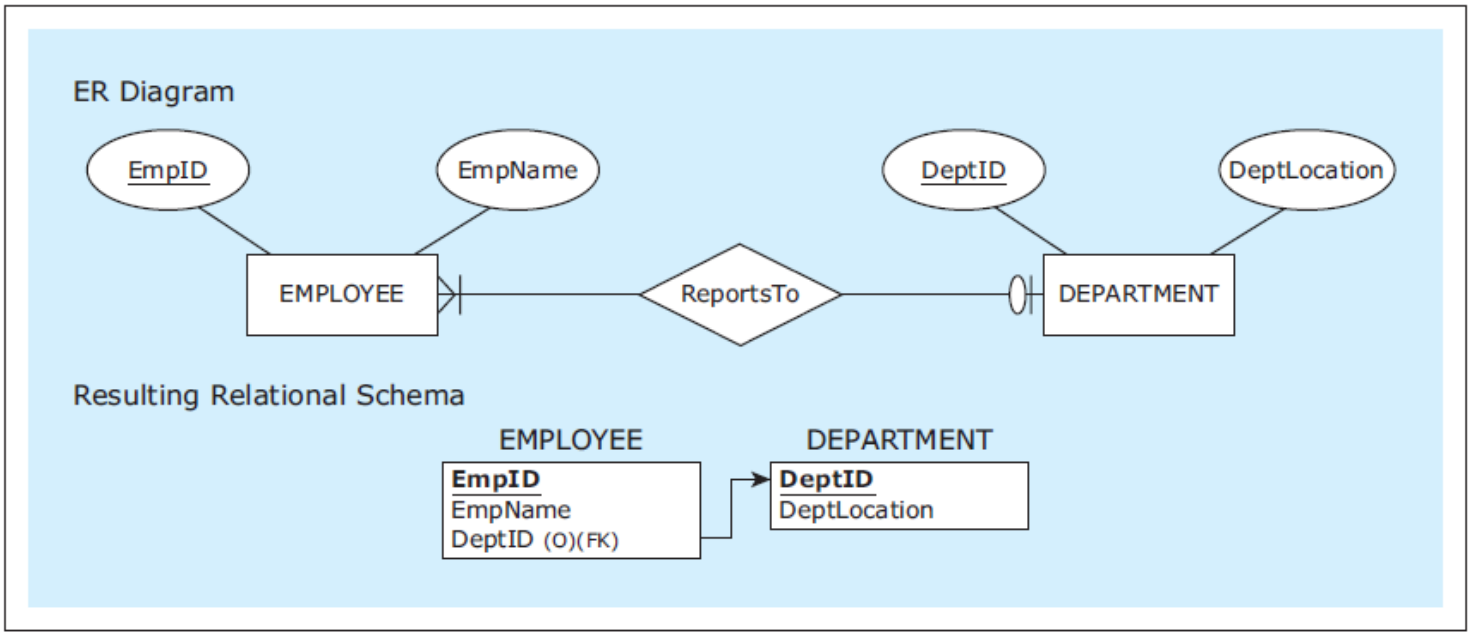
DEPARTMENT

DeptID	DeptLocation
1	Suite A
2	Suite B

MAPPING RELATIONSHIPS

Example - Mapping a 1:M relationship

Optional participation on the 1 side



Sample data records for the mapped ER diagram

EMPLOYEE

EmpID	EmpName	DeptID
1234	Becky	1
2345	Molly	2
3456	Rob	
1324	Ted	2

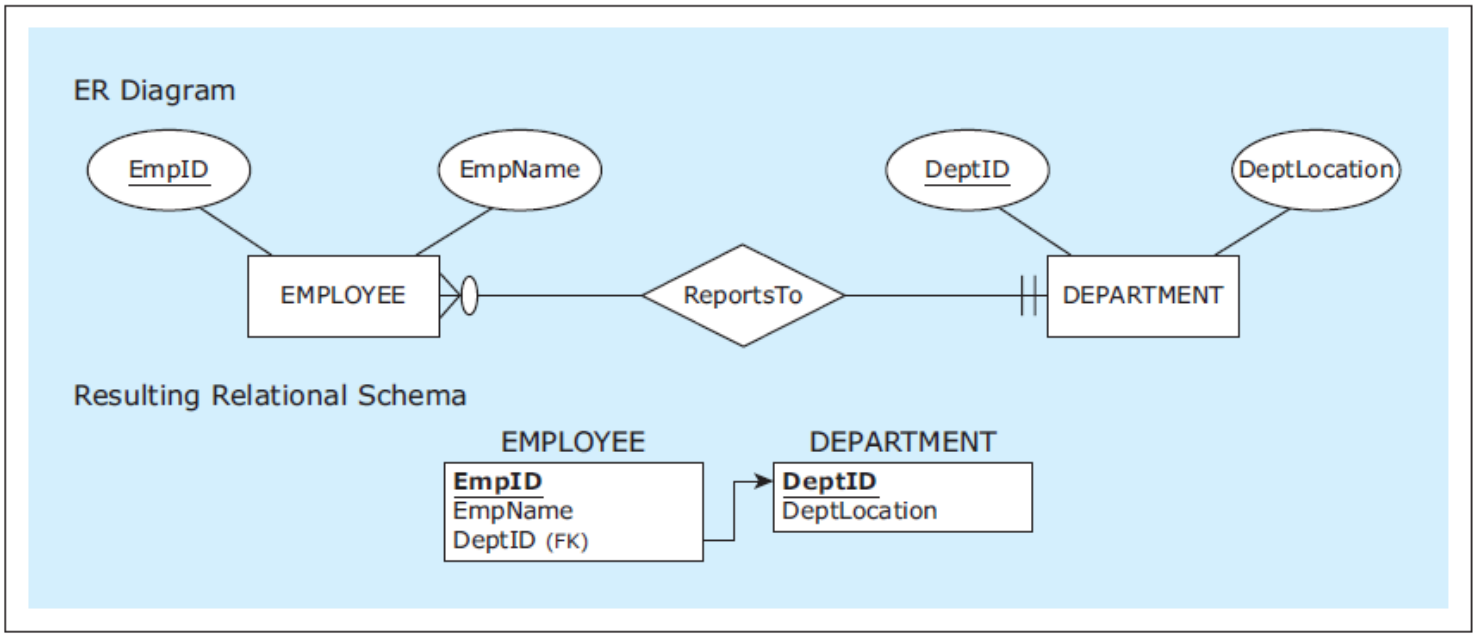
DEPARTMENT

DeptID	DeptLocation
1	Suite A
2	Suite B

MAPPING RELATIONSHIPS

Example - Mapping a 1:M relationship

Optional participation on the M side



Sample data records for the mapped ER diagram

EMPLOYEE

EmpID	EmpName	DeptID
1234	Becky	1
2345	Molly	2
3456	Rob	1
1324	Ted	2

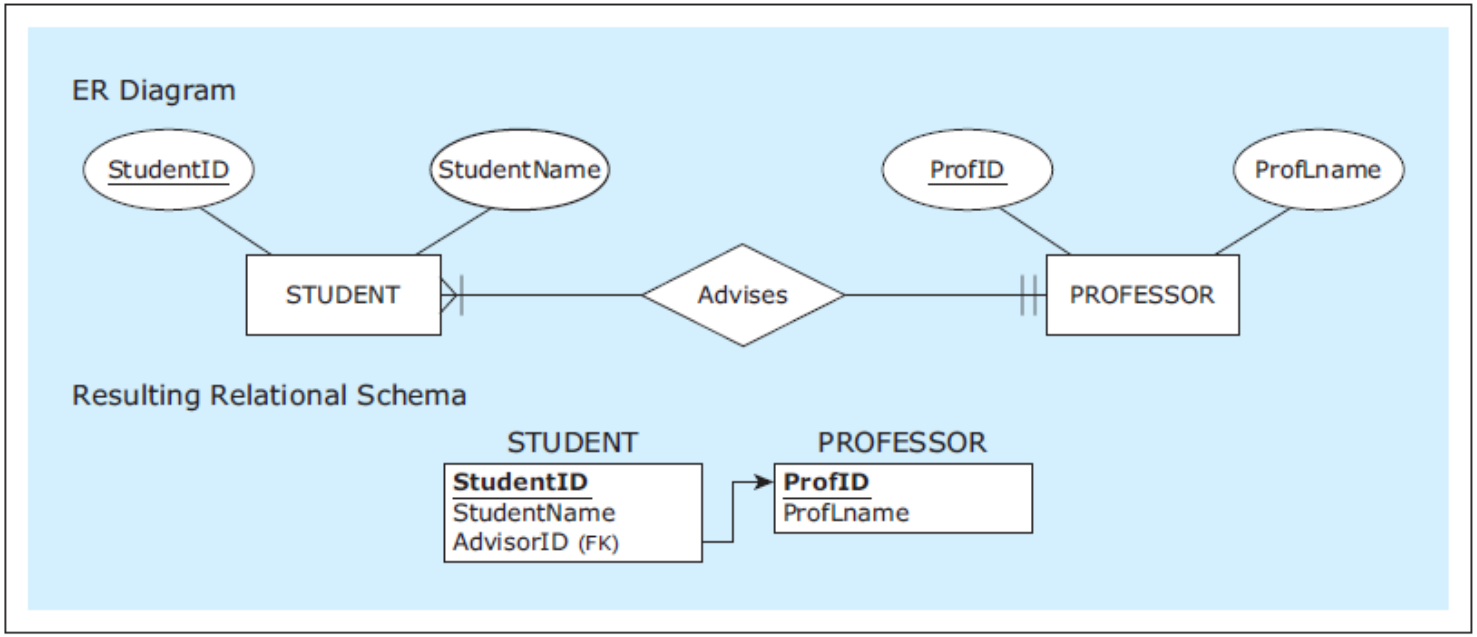
DEPARTMENT

DeptID	DeptLocation
1	Suite A
2	Suite B
3	Suite C

MAPPING RELATIONSHIPS

Example - Mapping a 1:M relationship

Renaming a foreign key



Sample data records for the mapped ER diagram

STUDENT

StudentID	StudentName	AdvisorID
1111	Robin	P11
2222	Pat	P22
3333	Jami	P11

PROFESSOR

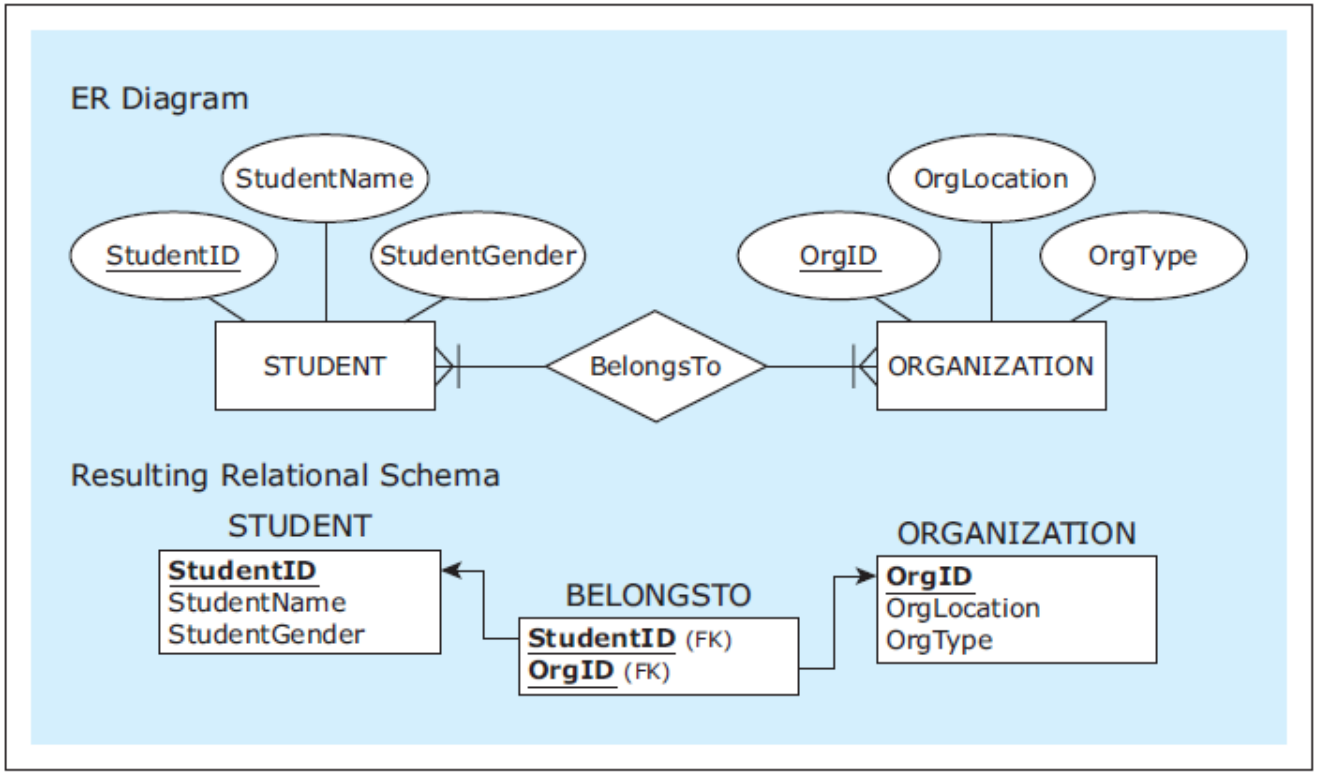
ProfID	ProfLname
P11	Zydiak
P22	Lash

MAPPING RELATIONSHIPS

- **Mapping M:N relationships**
  - *In addition to the two relations representing the two entities involved in the M:N relationship,* ***another relation*** *is created to* ***represent the M:N relationship*** *itself*
  - *This new relation has* ***two foreign keys****, corresponding to the primary keys of the two relations representing the two entities involved in the M:N relationship*
  - *The* ***two foreign keys form the composite primary key*** *of the new relation*

MAPPING RELATIONSHIPS

Example - Mapping an M:N relationship



Sample data records for the mapped ER diagram

STUDENT

StudentID	StudentName	StudentGender
1111	Robin	Male
2222	Pat	Male
3333	Jami	Female

ORGANIZATION

OrgID	OrgLocation	OrgType
O11	Student Hall	Charity
O41	Damen Hall	Sport
O47	Student Hall	Charity

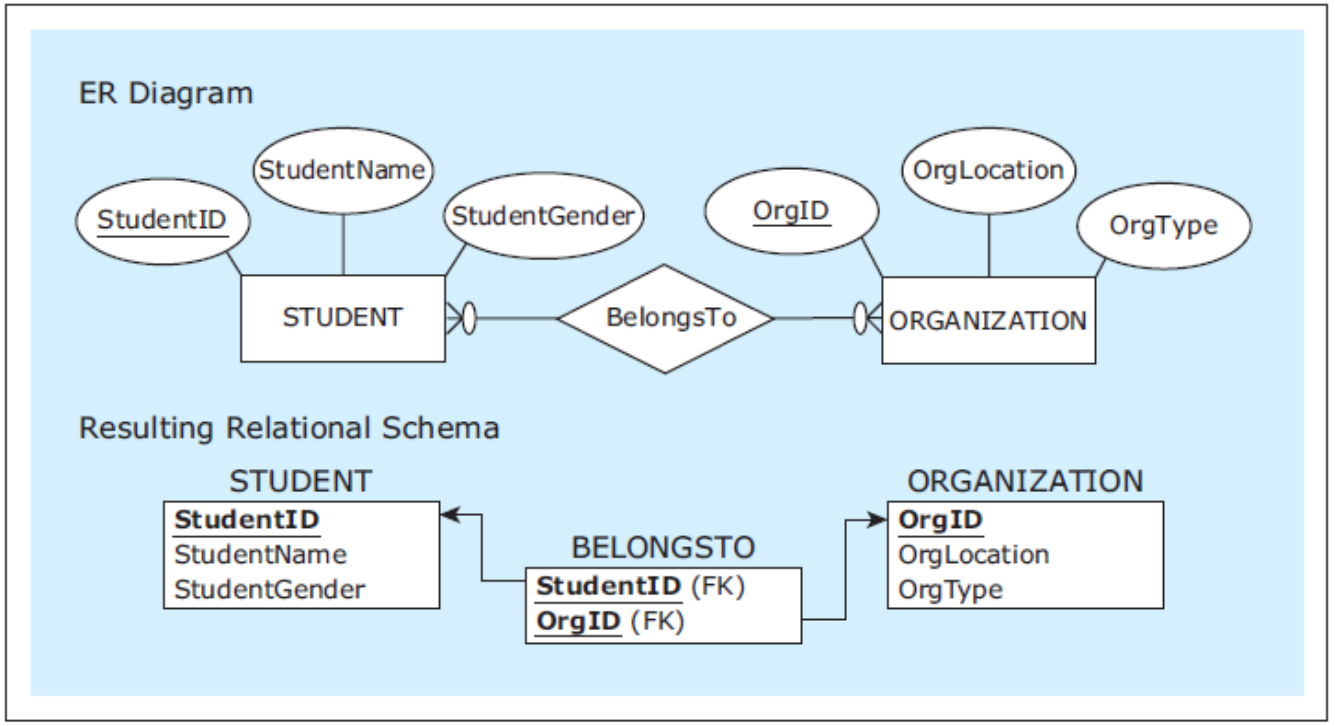
BELONGSTO

StudentID	OrgID
1111	O11
1111	O41
2222	O11
2222	O41
2222	O47
3333	O11

MAPPING RELATIONSHIPS

Example - Mapping an M:N relationship

Optional participation on both sides



Sample data records for the mapped ER diagram

STUDENT

StudentID	StudentName	StudentGender
1111	Robin	Male
2222	Pat	Male
3333	Jami	Female
4444	Abby	Female

ORGANIZATION

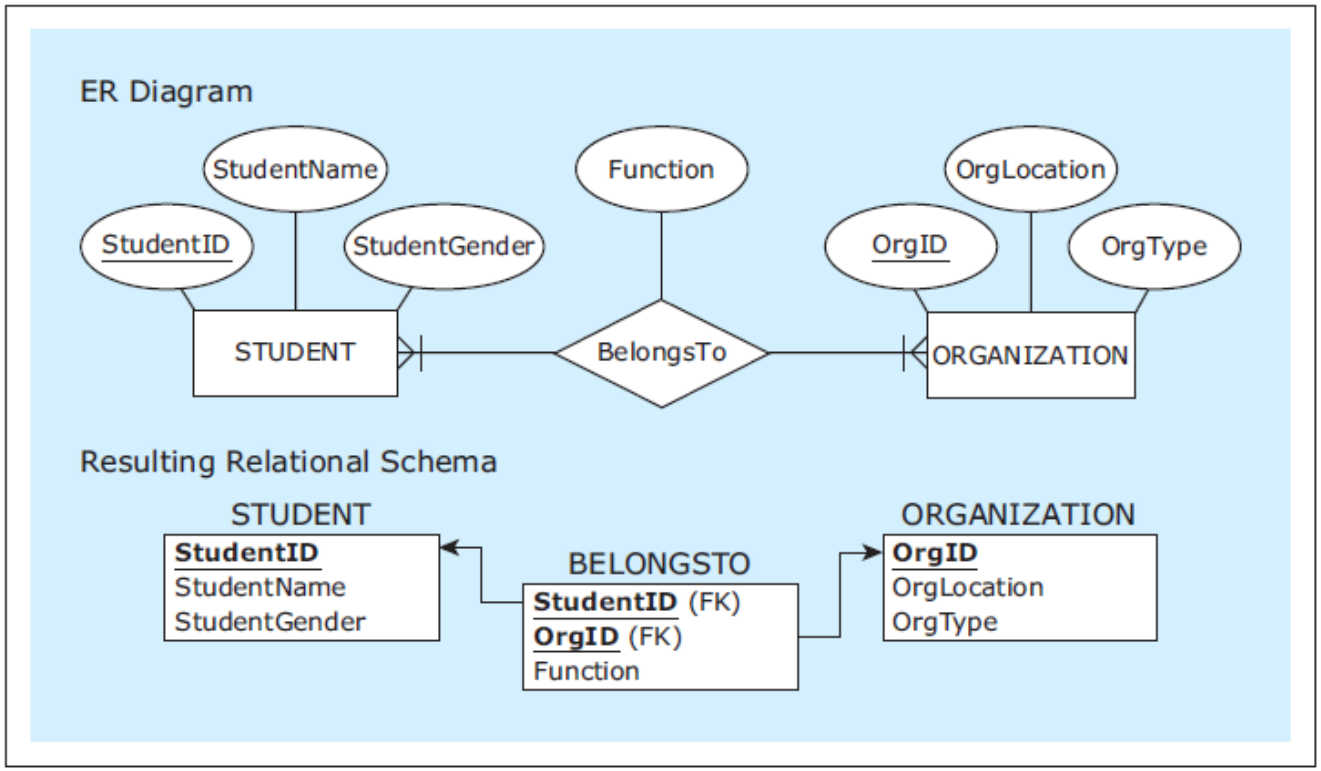
OrgID	OrgLocation	OrgType
O11	Student Hall	Charity
O41	Damen Hall	Sport
O47	Student Hall	Charity
O50	Damen Hall	Politics

BELONGSTO

StudentID	OrgID
1111	O11
1111	O41
2222	O11
2222	O41
2222	O47
3333	O11

MAPPING RELATIONSHIPS

Example - Mapping a M:N relationship with an attribute



Sample data records for the mapped ER diagram

STUDENT

StudentID	StudentName	StudentGender
1111	Robin	Male
2222	Pat	Male
3333	Jami	Female

ORGANIZATION

OrgID	OrgLocation	OrgType
O11	Student Hall	Charity
O41	Damen Hall	Sport
O47	Student Hall	Charity

BELONGSTO

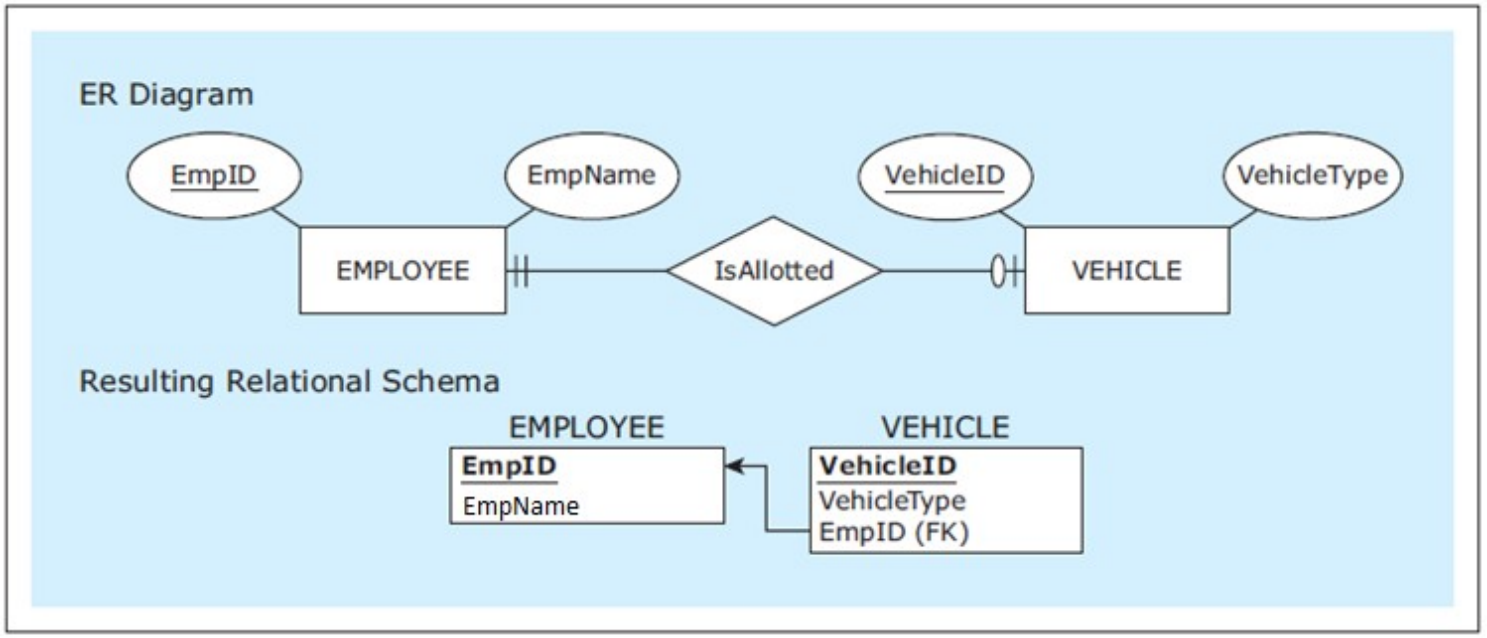
StudentID	OrgID	Function
1111	O11	President
1111	O41	Member
2222	O11	V.P.
2222	O41	Member
2222	O47	Treasurer
3333	O11	Member

MAPPING RELATIONSHIPS

- **Mapping 1:1 relationships**
  - 1:1 relationships are mapped in the same way as 1:M relationships
  - One of the resulting relations will have a foreign key pointing to the primary key of another resulting relation
  - One of the mapped relations is chosen to have a foreign key referring to the primary key of the other mapped relation
    - In cases when there is no particular advantage in choosing which resulting relation will include a foreign key, the choice can be arbitrary
    - In other cases one choice can be more efficient than the other

MAPPING RELATIONSHIPS

Example - Mapping a 1:1 relationship



Sample data records for the mapped ER diagram

EMPLOYEE

EmpID	EmpName
1234	Becky
2345	Molly
3456	Rob
1324	Ted

VEHICLE

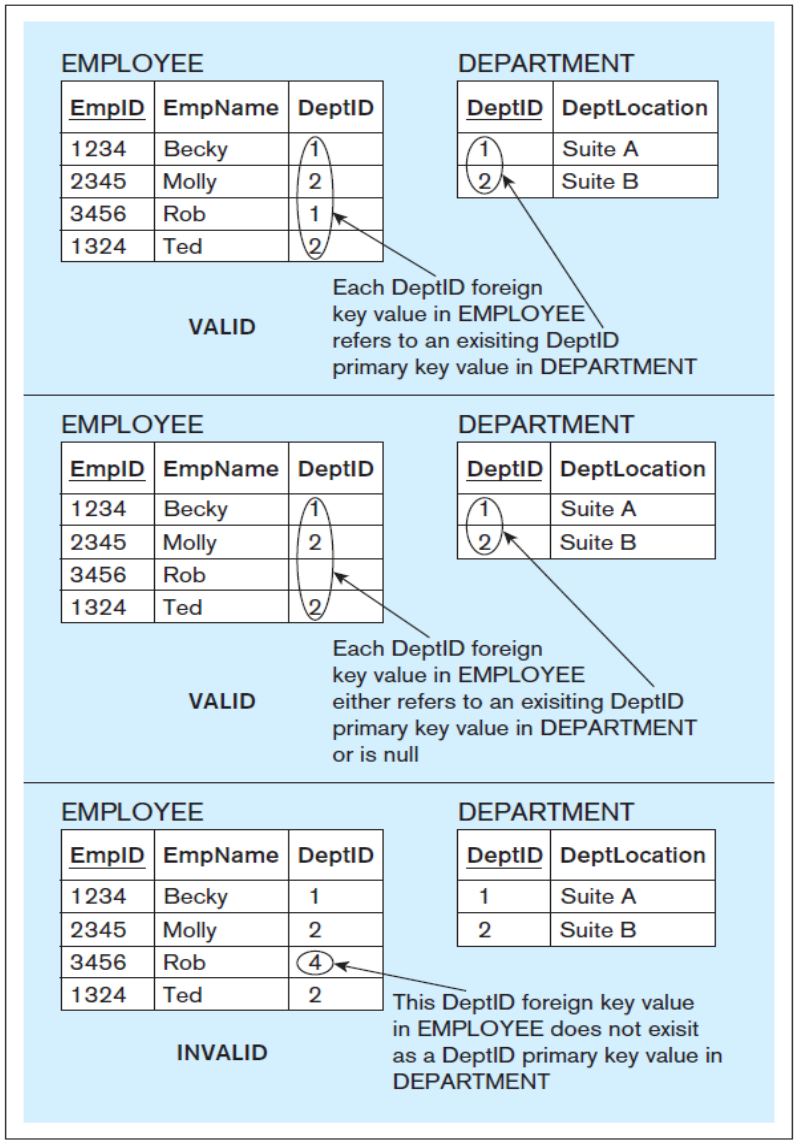
VehicleID	Vehicletype	EmpID
111	Sedan	1234
222	Van	2345
333	Van	3456

REFERENTIAL INTEGRITY CONSTRAINT

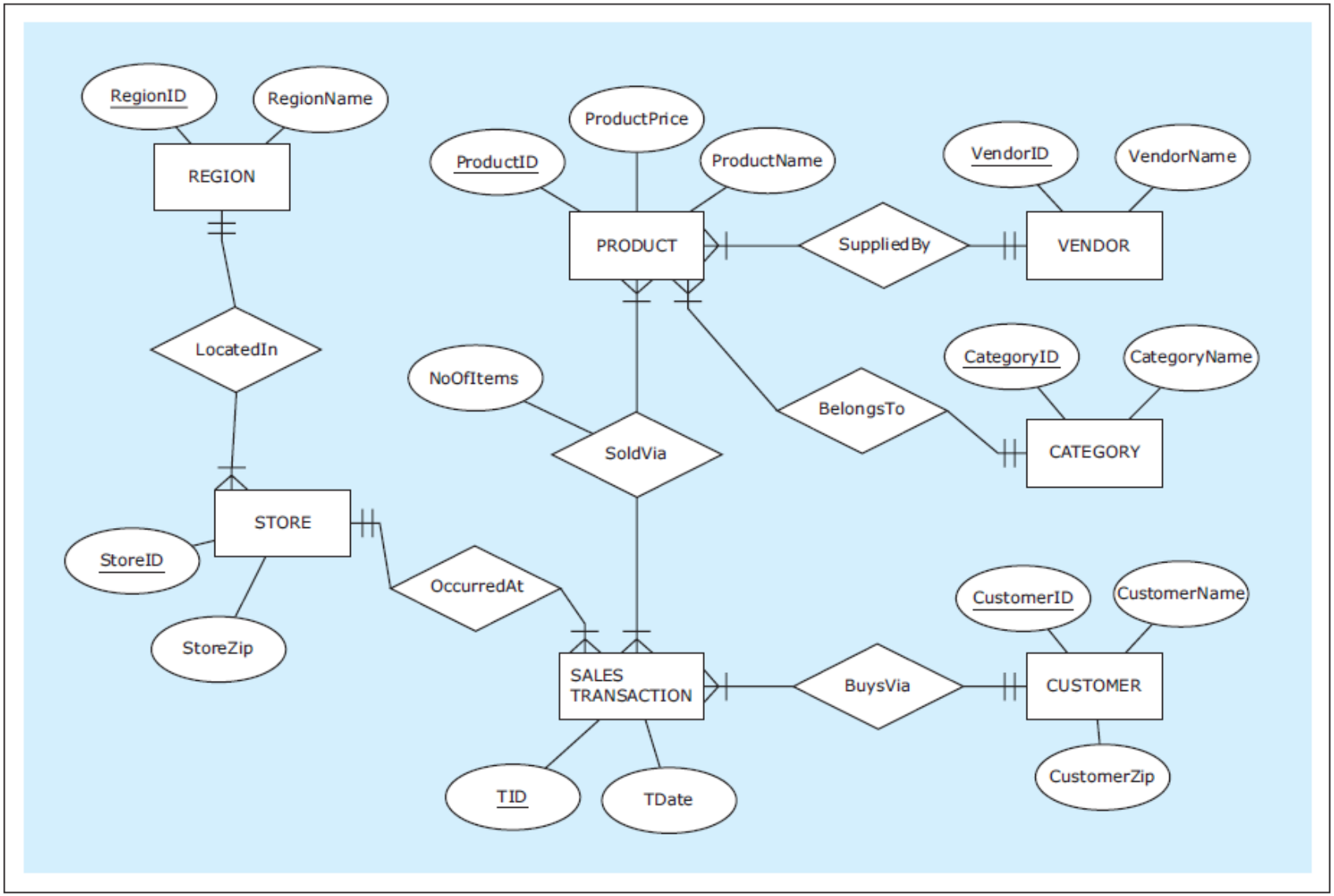
- **Referential integrity constraint -** *In each row of a relation containing a foreign key, the value of the* ***foreign key EITHER matches*** *one of the values in the* ***primary key*** *column of the referred relation* ***OR*** *the value of* ***the foreign key is null*** *(empty).*
  - A rule that defines values that are valid for use in foreign keys
  - In a relational schema lines pointing from the foreign key to the corresponding primary key are referred to as **referential integrity constraint lines**

REFERENTIAL INTEGRITY CONSTRAINT

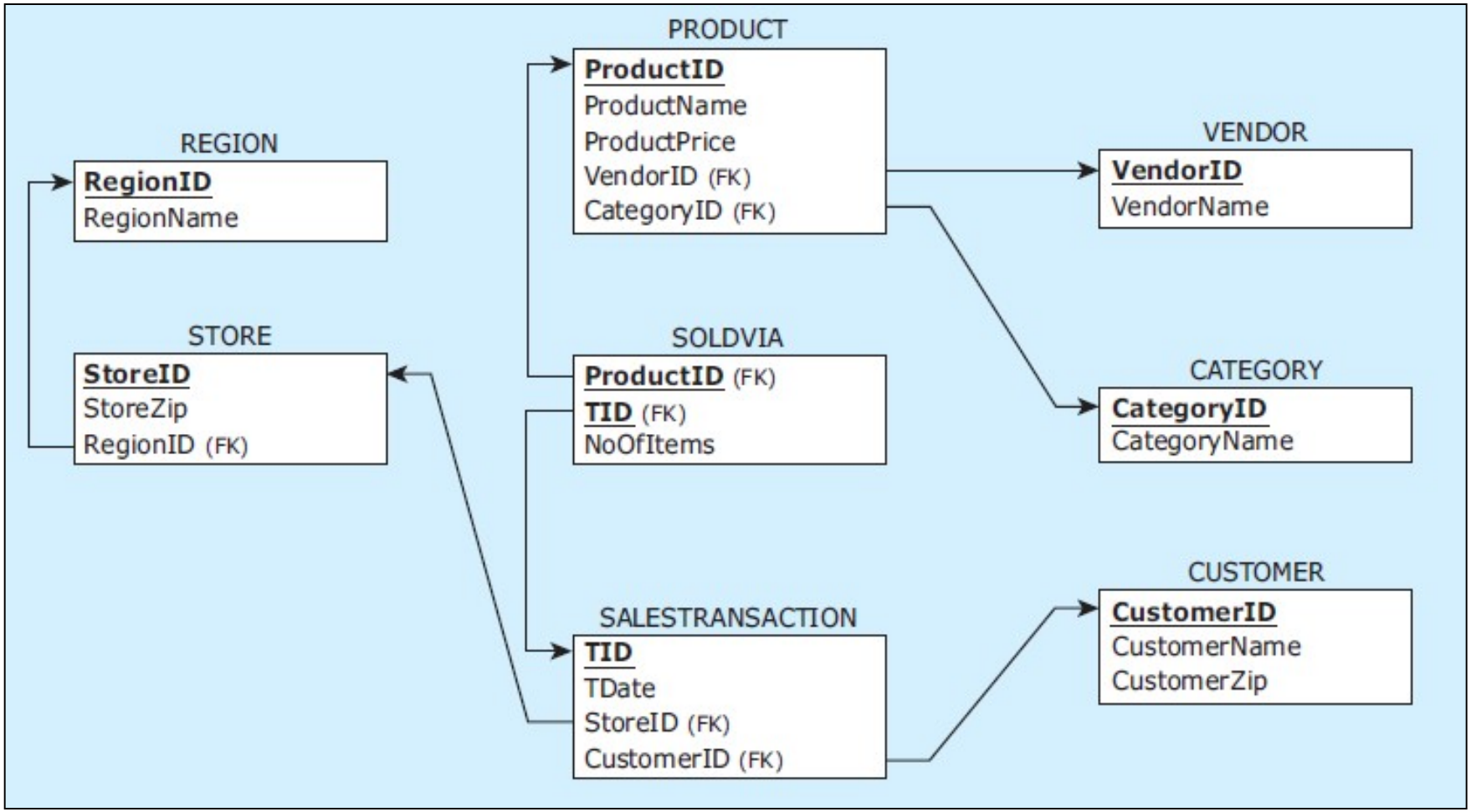
Referential integrity constraint — compliance and violation examples



Example ER diagram : ZAGI Retail Company Sales Department Database



Example mapped relational schema: ZAGI Retail Company Sales Department Database



Example: Sample data records for the ZAGI Retail Company Sales Department Database

REGION

RegionID	RegionName
C	Chicagoland
T	Tristate

PRODUCT

ProductID	ProductName	ProductPrice	VendorID	CategoryID
1X1	Zzz Bag	$100	PG	CP
2X2	Easy Boot	$70	MK	FW
3X3	Cosy Sock	$15	MK	FW
4X4	Dura Boot	$90	PG	FW
5X5	Tiny Tent	$150	MK	CP
6X6	Biggy Tent	$250	MK	CP

VENDOR

VendorID	VendorName
PG	Pacifica Gear
MK	Mountain King

STORE

StoreID	StoreZip	RegionID
S1	60600	C
S2	60605	C
S3	35400	T

CATEGORY

CategoryID	CategoryName
CP	Camping
FW	Footwear

SALES TRANSACTION

TID	CustomerID	StoreID	TDate
T111	1-2-333	S1	1-Jan-2013
T222	2-3-444	S2	1-Jan-2013
T333	1-2-333	S3	2-Jan-2013
T444	3-4-555	S3	2-Jan-2013
T555	2-3-444	S3	2-Jan-2013

SOLDVIA

ProductID	TID	NoOfItems
1X1	T111	1
2X2	T222	1
3X3	T333	5
1X1	T333	1
4X4	T444	1
2X2	T444	2
4X4	T555	4
5X5	T555	2
6X6	T555	1

CUSTOMER

CustomerID	CustomerName	CustomerZip
1-2-333	Tina	60137
2-3-444	Tony	60611
3-4-555	Pam	35401

UNARY RELATIONSHIP MAPPING

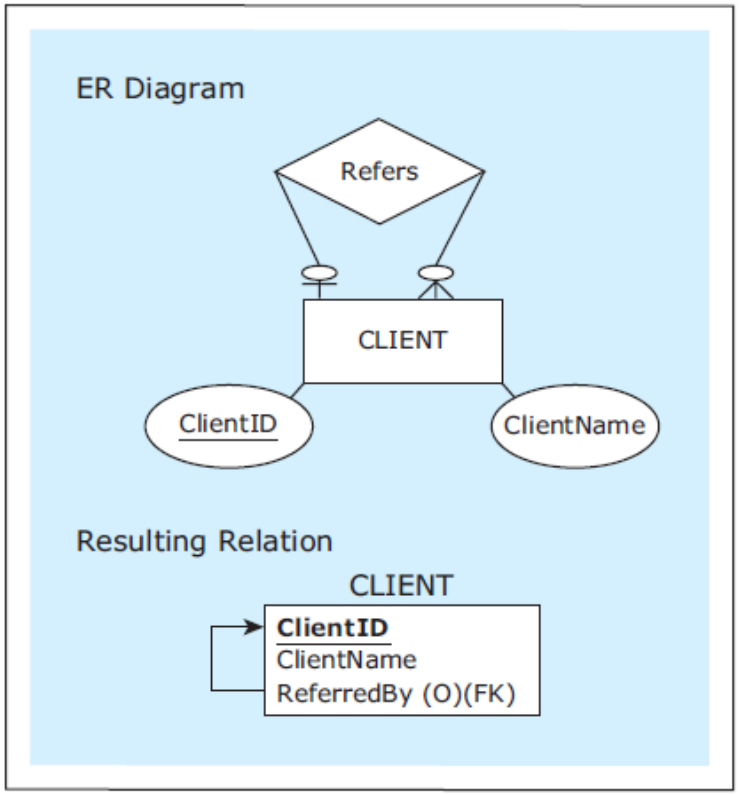
- **Mapping unary relationships**
  - Unary relationships in ER diagrams are mapped in the same way as binary relationships

MAPPING UNARY RELATIONSHIPS

- **Mapping 1:M unary relationships**
  - The relation mapped from an entity involved in a 1:M unary relationship contains a **foreign key** that **corresponds to its own primary key**

MAPPING UNARY RELATIONSHIPS

Mapping a 1:M unary relationship



Client can be referred by only one client but can refer multiple clients

Sample data records for the mapped relation

CLIENT

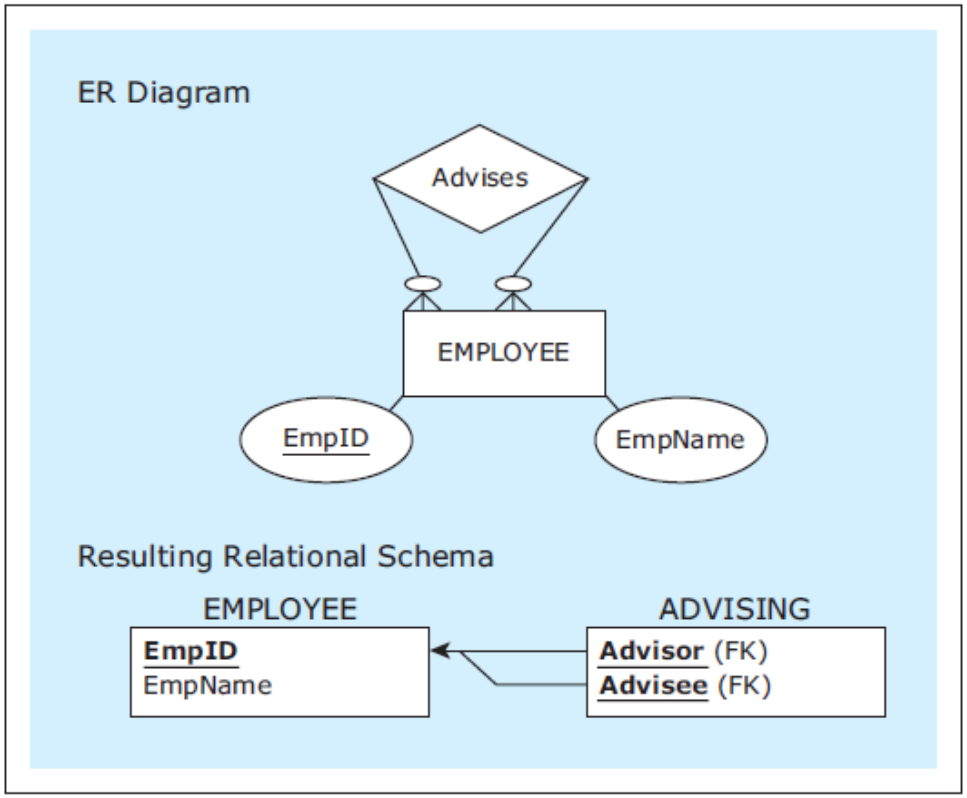
ClientID	ClientName	ReferredBy
C111	Mark	
C222	Mike	C111
C333	Lilly	C111
C444	Jane	C222

MAPPING UNARY RELATIONSHIPS

- **Mapping M:N unary relationships**
  - *In addition to the relation representing the entity involved in a unary M:N relationship, another relation is created to* ***represent the M:N relationship itself***
  - *This new relation has* ***two foreign keys****, both of them corresponding to the primary key of the relation representing the entity involved in the unary M:N relationship*
  - *Each of the* ***foreign keys is used as a part of the composite primary key*** *of the new relation*

MAPPING UNARY RELATIONSHIPS

Mapping a M:N unary relationship



Sample data records for the mapped relations

EMPLOYEE

EmpID	EmpName
1234	Becky
2345	Molly
3456	Rob
1324	Ted

ADVISING

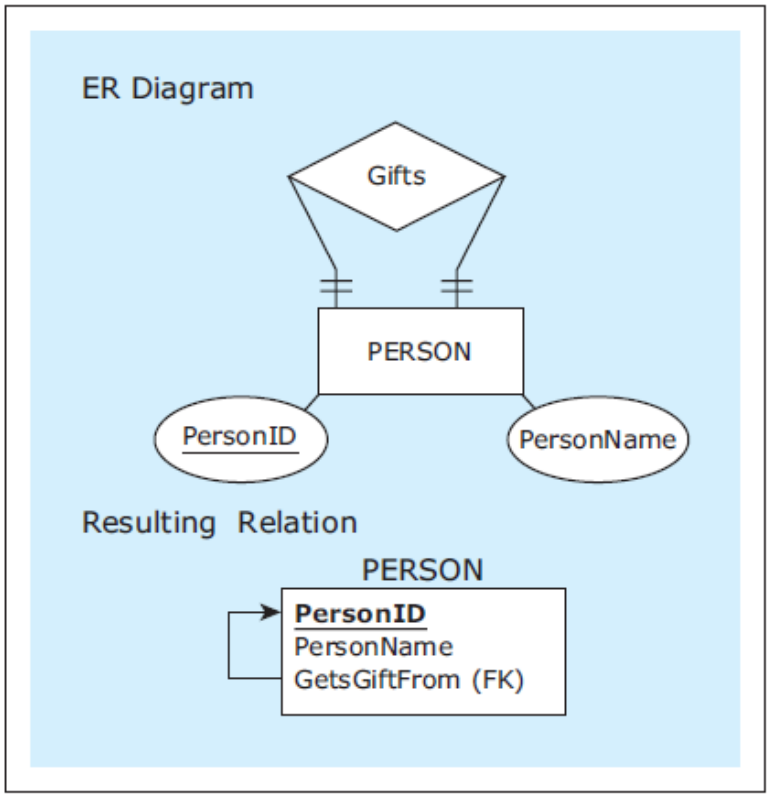
Advisor	Advisee
1234	2345
1234	3456
2345	1324
3456	1324
1234	1324

MAPPING UNARY RELATIONSHIPS

- **Mapping 1:1 unary relationships**
  - Mapped in the same way as 1:M unary relationships

MAPPING UNARY RELATIONSHIPS

Mapping a 1:1 unary relationship



Sample data records for the mapped relation

PERSON

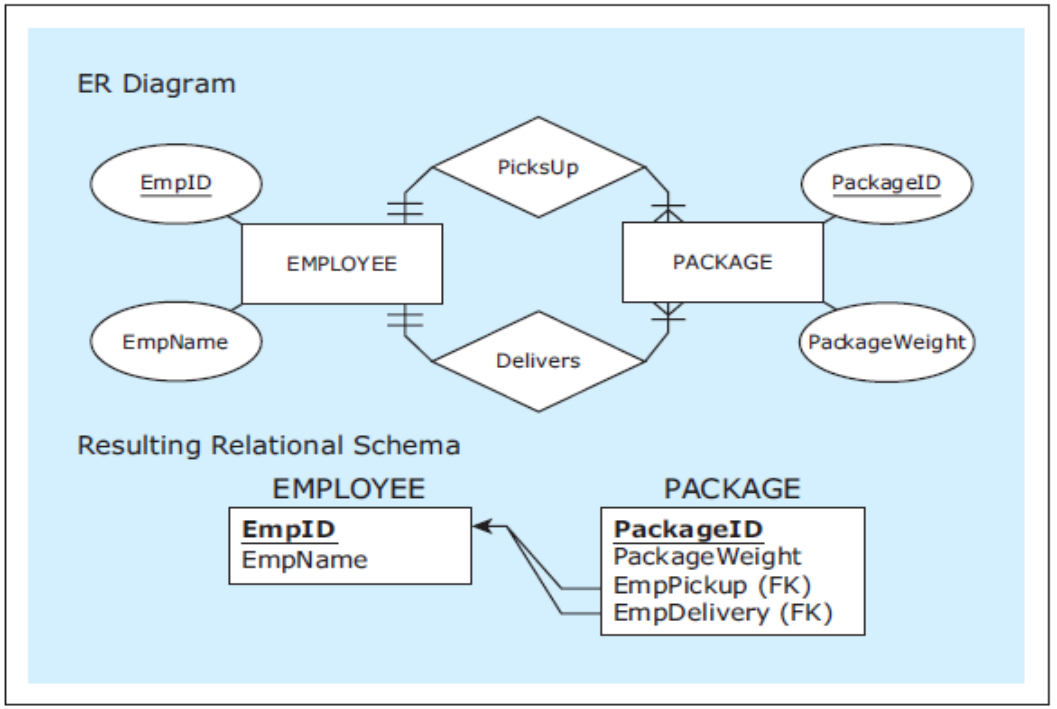
PersonID	PersonName	GetsGiftFrom
P111	Rose	P333
P222	Violet	P111
P333	James	P444
P444	Lena	P222

MAPPING MULTIPLE RELATIONSHIPS BETWEEN THE SAME ENTITIES

- **Mapping multiple relationships between the same entities**
  - Each relationship is mapped

MAPPING MULTIPLE RELATIONSHIPS BETWEEN THE SAME ENTITIES

Mapping multiple relationships between the same entities



Sample data records for the mapped relations

EMPLOYEE

EmpID	EmpName
1234	Becky
2345	Molly
3456	Rob
1324	Ted

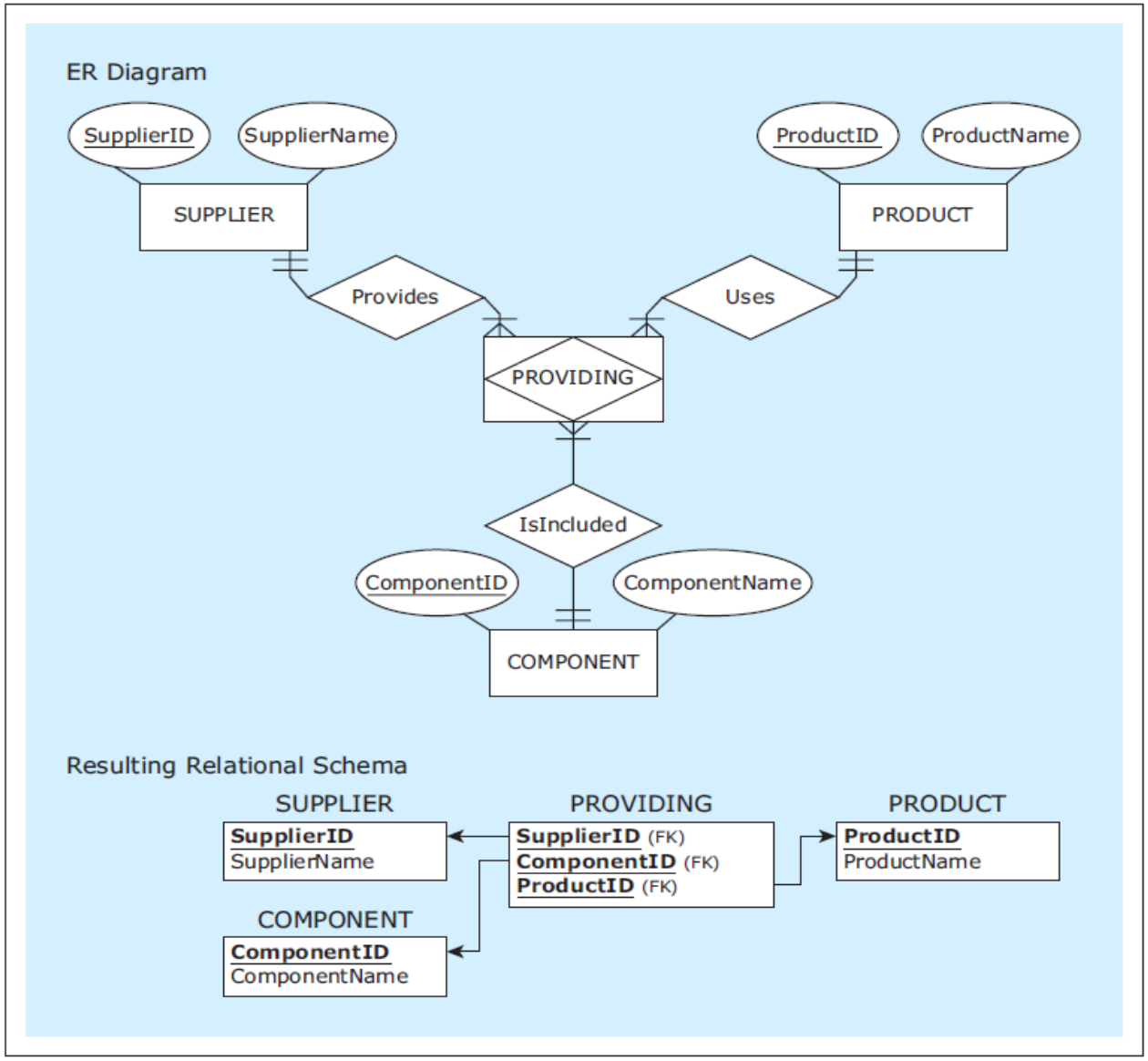
PACKAGE

PackageID	PackageWeight	EmpPickup	EmpDelivery
P111	5	1234	2345
P222	12	1234	1324
P333	3	2345	1234
P444	10	3456	1234
P555	7	1324	3456

MAPPING TERNARY RELATIONSHIPS

- **Mapping ternary relationships**
  - Ternary relationships are used as many-to-many-to-many relationships
  - A new relation is created with foreign keys from the participating entities forming a composite primary key of the new relation

Example: Mapping a ternary relationship



Example: Sample data records for the mapped relations

SUPPLIER

SupplierID	SupplierName
S1	Acme
S2	Xparts
S3	Compy

PRODUCT

ProductID	ProductName
P1	Bicycle
P2	Tricycle
P3	Scooter

COMPONENT

ComponentID	ComponentName
C1	Wheel
C2	Handle
C3	Seat

PROVIDING

SupplierID	ProductID	ComponentID
S1	P1	C1
S2	P1	C1
S3	P1	C1
S1	P1	C2
S2	P1	C2
S3	P1	C2
S1	P1	C3
S2	P1	C3
S3	P1	C3
S1	P2	C1
S1	P2	C2
S1	P2	C3
S1	P3	C1
S1	P3	C2