IT 775
Database Technology

Relational Database (RD) Modeling

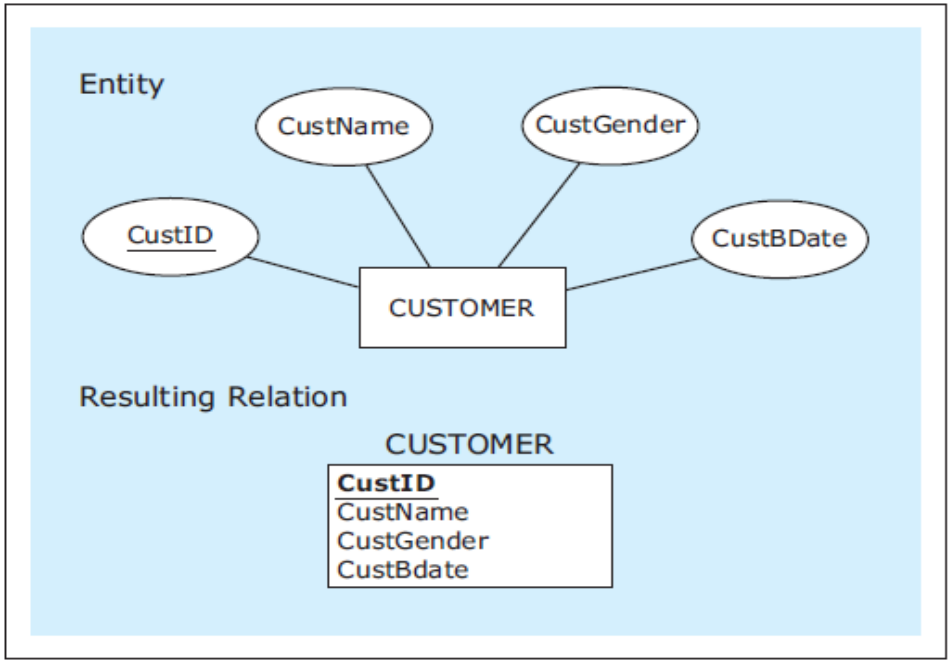
Entity & Attribute Mapping

MAPPING ENTITIES

- **Mapping entities into relations**
  - Each regular entity becomes a relation
  - Each regular attribute of a regular entity becomes a column of the newly created relation
  - If an entity has a single unique attribute, then that attribute becomes the primary key in the resulting mapped relation

MAPPING ENTITIES

Entity mapped into a relation



Sample data records for the mapped relation

CUSTOMER

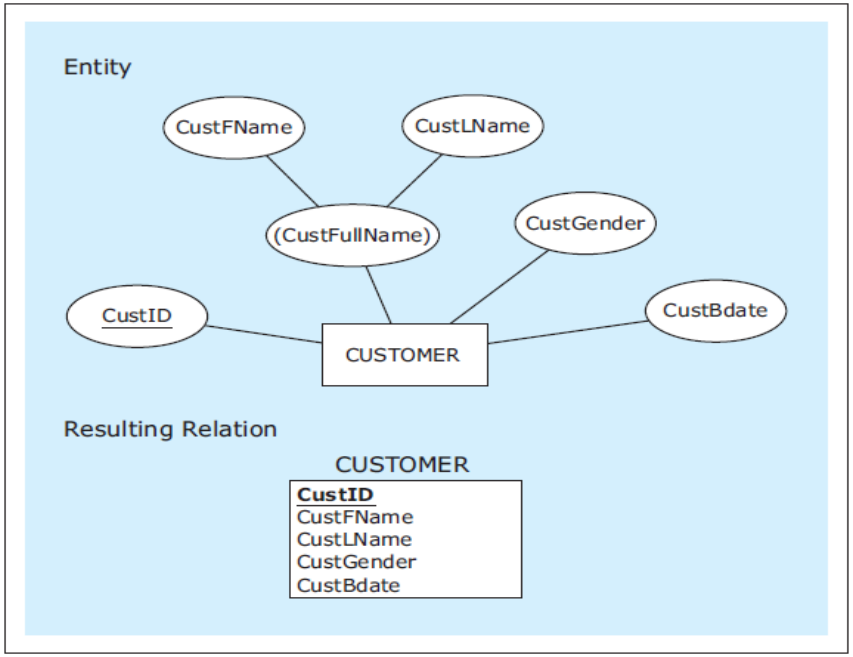
CustID	CustName	CustGender	CustBdate
1111	Tom	M	1/1/1965
2222	Jenny	F	2/2/1968
3333	Greg	M	1/2/1962
4444	Sophia	F	2/2/1983

MAPPING ENTITIES WITH COMPOSITE ATTRIBUTES

- **Mapping entities with composite attributes into relations**
  - Each component of a composite attribute is mapped as a column of a relation
  - The composite attribute itself does not appear in the mapped relation

MAPPING ENTITIES WITH COMPOSITE ATTRIBUTES

Entity with a composite attribute mapped into a relation



Sample data records for the mapped relation

CUSTOMER

CustID	CustFName	CustLName	CustGender	CustBdate
1111	Tom	Lendrum	M	1/1/1965
2222	Jenny	Jones	F	2/2/1968
3333	Greg	Newton	M	1/2/1962
4444	Sophia	Danks	F	2/2/1983

MAPPING ENTITIES WITH COMPOSITE ATTRIBUTES

The mapped relation as presented to a user in a front-end application

CUSTOMER

	CustFullName			
CustID	CustFName	CustLName	CustGender	CustBdate
1111	Tom	Lendrum	M	1/1/1965
2222	Jenny	Jones	F	2/2/1968
3333	Greg	Newton	M	1/2/1962
4444	Sophia	Danks	F	2/2/1983

COMPOSITE PRIMARY KEY

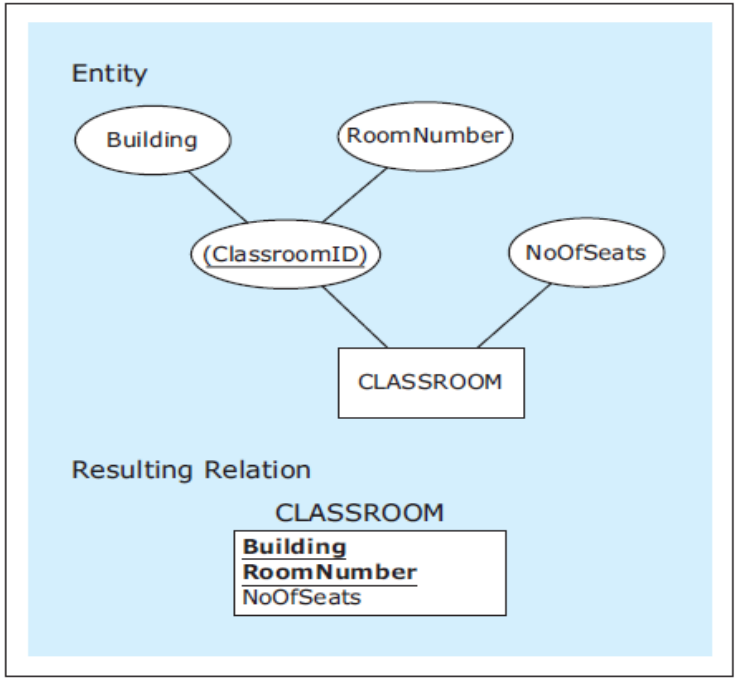
- **Composite primary key -** a primary key that is composed of multiple columns
  - Column names of a composite primary key are underlined, because combined together they form the primary key

MAPPING ENTITIES WITH UNIQUE COMPOSITE ATTRIBUTES

- **Mapping entities with unique composite attributes into relations**
  - An entity whose only unique attribute is a composite attribute is mapped as a relation with a composite primary key

MAPPING ENTITIES WITH UNIQUE COMPOSITE ATTRIBUTES

Entity with a unique composite attribute mapped into a relation



Sample data records for the mapped relation

CLASSROOM

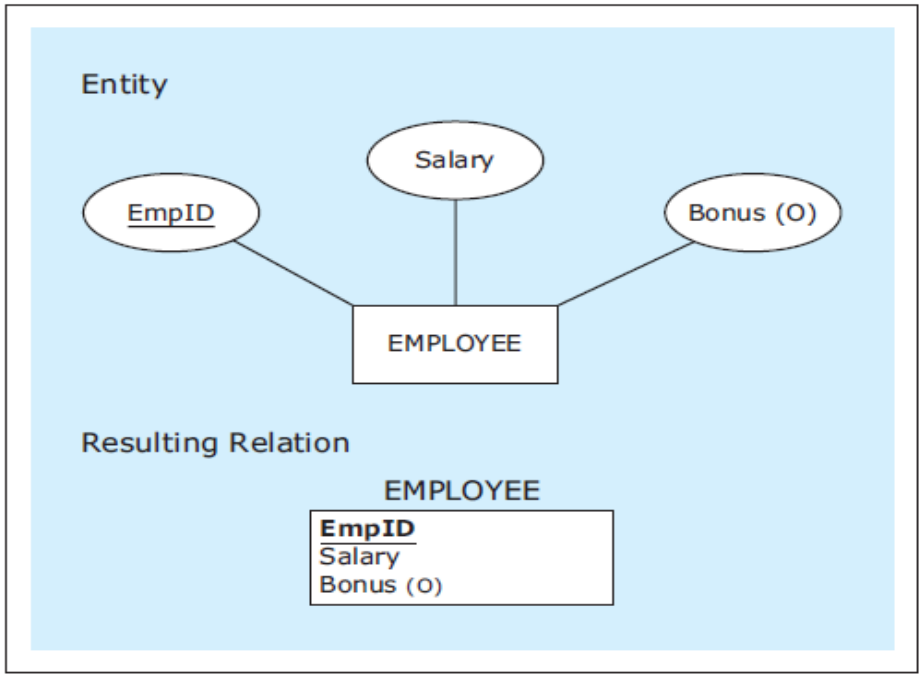
Building	RoomNumber	NoOfSeats
Maguire	110	100
Maguire	210	50
Houser	110	50
Houser	210	50

MAPPING ENTITIES WITH OPTIONAL ATTRIBUTES

- **Mapping entities with optional attributes into relations**
  - Optional attribute of an entity is mapped as an optional column

MAPPING ENTITIES WITH OPTIONAL ATTRIBUTES

Entity with an optional attribute mapped into a relation



Sample data records for the mapped relation

EMPLOYEE

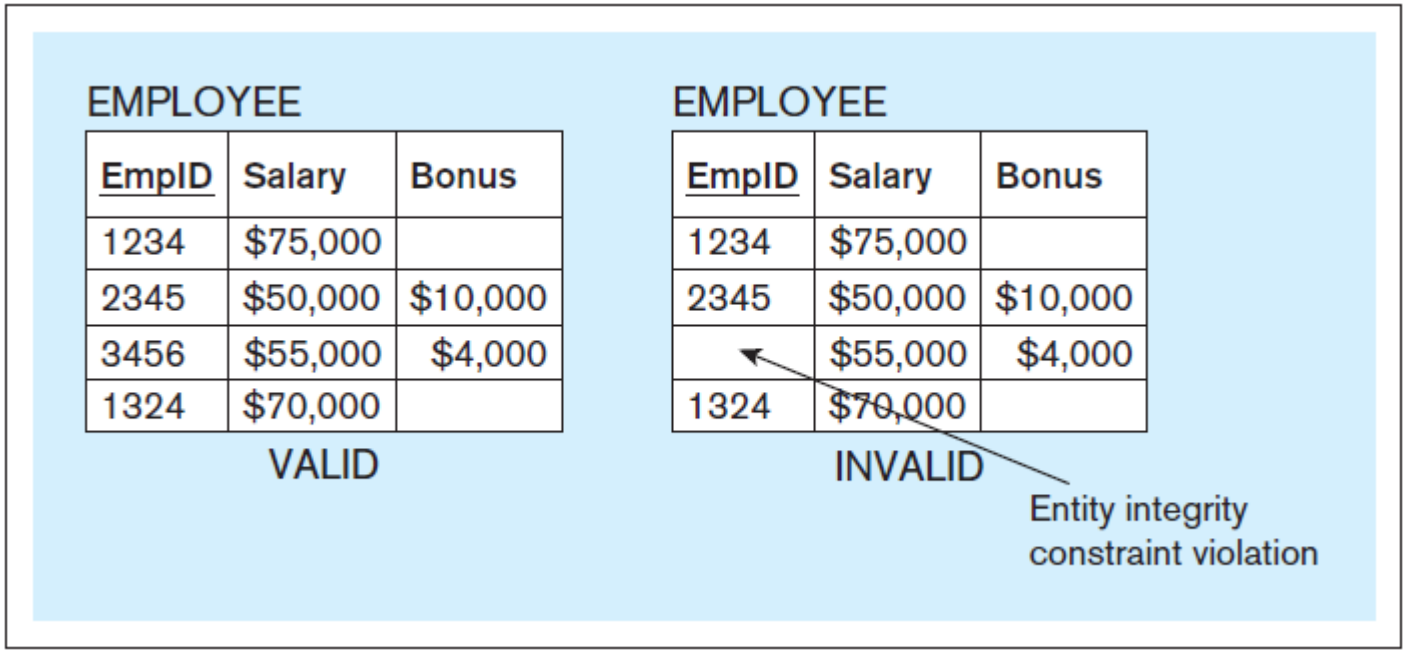
EmpID	Salary	Bonus
1234	$75,000	
2345	$45,000	$10,000
3456	$55,000	$4,000
1324	$70,000	

ENTITY INTEGRITY CONSTRAINT

- **Entity integrity constraint -** *in a relational table, no primary key column can have null (empty) values*
  - A rule stating that no primary key column can be optional
  - Every RBMS enforces this rule

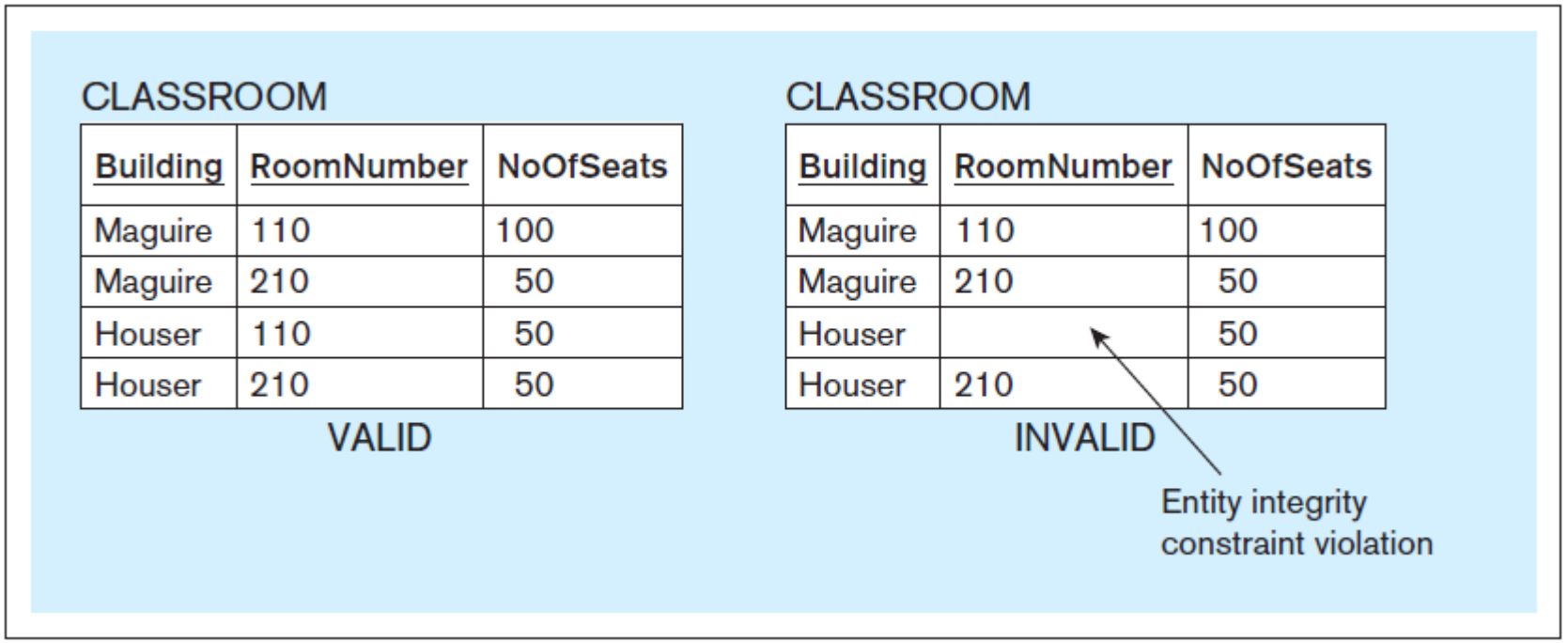
ENTITY INTEGRITY CONSTRAINT

Entity integrity constraint — compliance and violation example



ENTITY INTEGRITY CONSTRAINT

Entity integrity constraint — another compliance and violation example

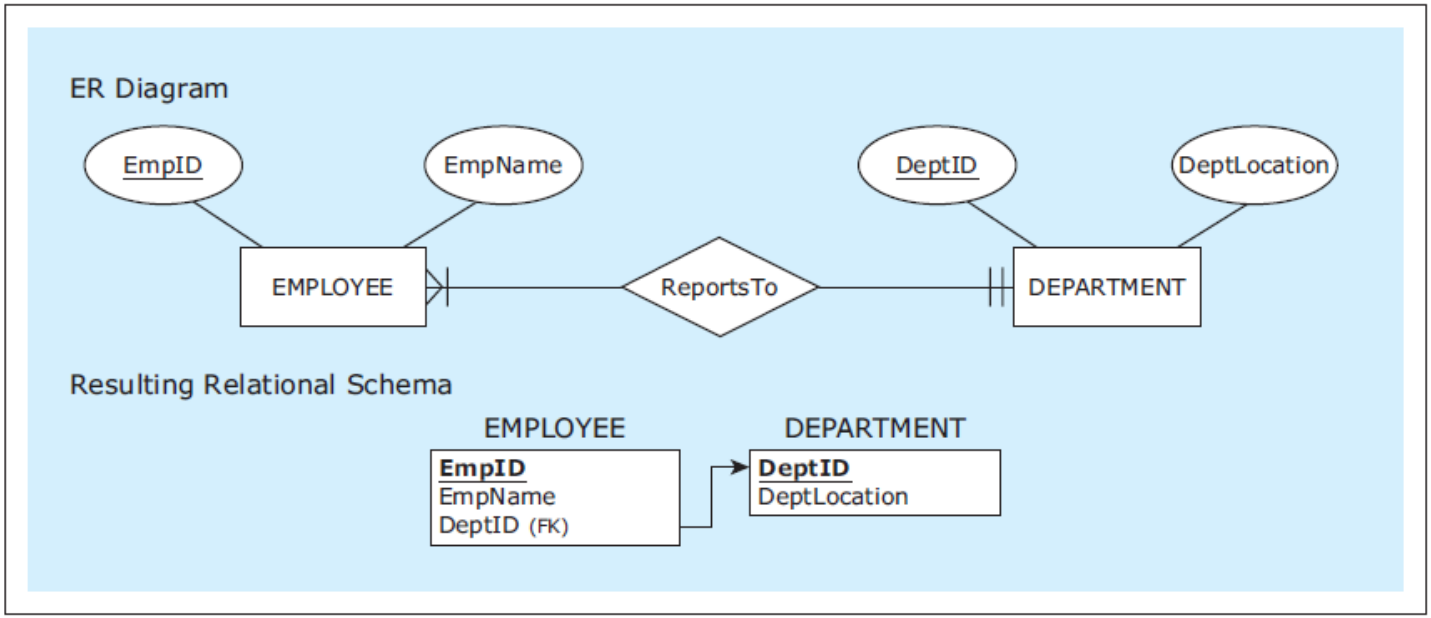


FOREIGN KEY

- **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

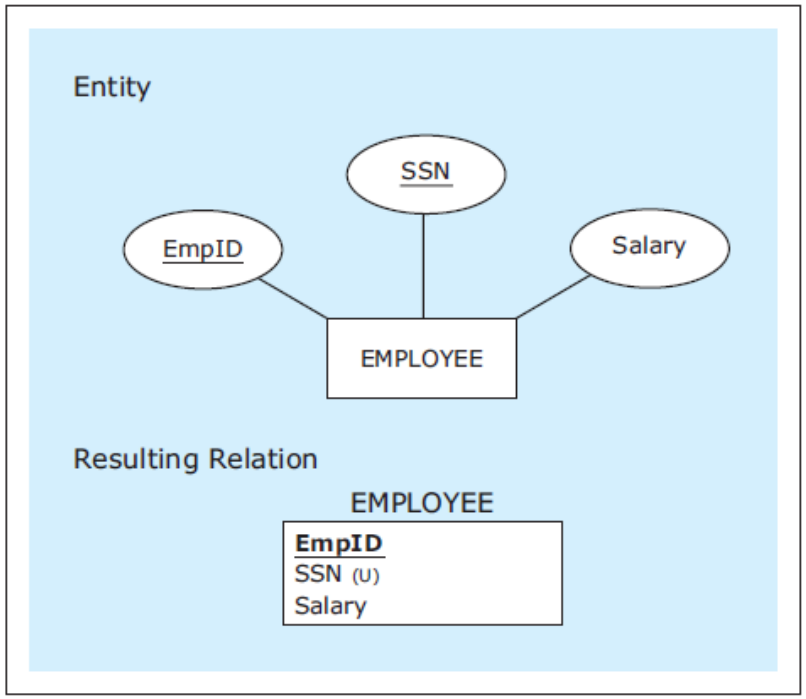
DeptID	DeptLocation
1	Suite A
2	Suite B

MAPPING CANDIDATE KEYS

- **Mapping entities with candidate keys (multiple unique attributes) into relations**
  - One of the candidate keys is chosen by database designer as a primary key during the mapping process
  - Other candidate keys are mapped as non-primary key columns

MAPPING ENTITIES WITH CANDIDATE KEYS (MULTIPLE UNIQUE ATTRIBUTES)

Entity with candidate keys mapped into a relation



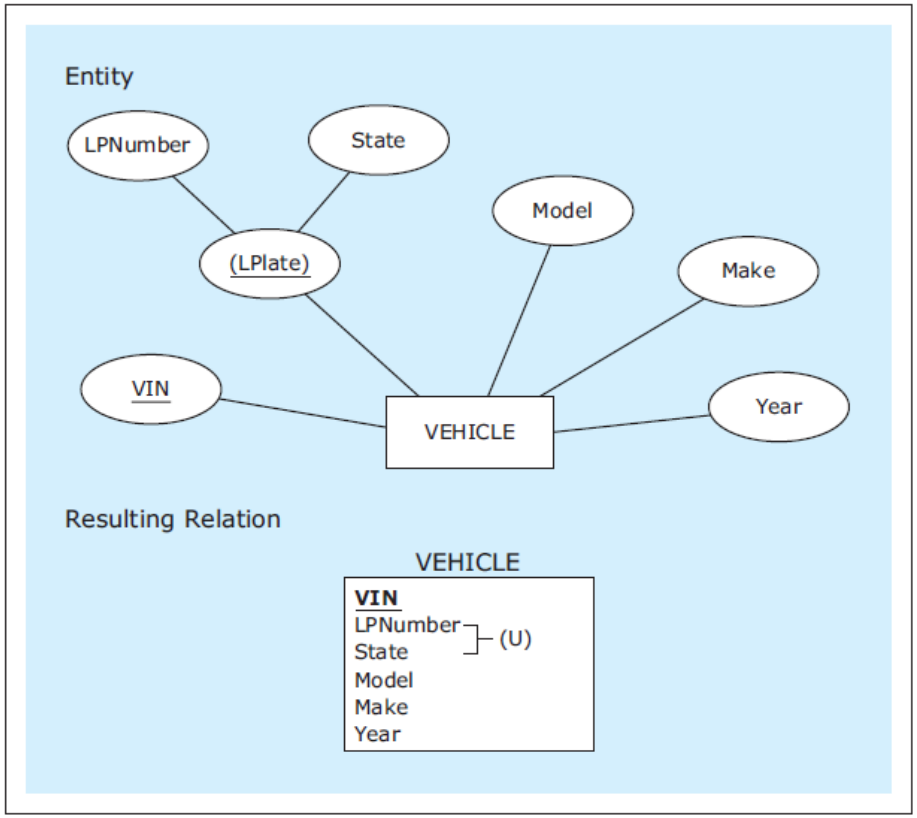
Sample data records for the mapped relation

EMPLOYEE

EmpID	SSN	Salary
1234	111-11-1111	$75,000
2345	222-22-2222	$50,000
3456	333-33-3333	$55,000
1324	444-44-4444	$70,000

MAPPING CANDIDATE KEYS

Entity with regular and composite candidate keys mapped into a relation



Sample data records for the mapped relation

VEHICLE

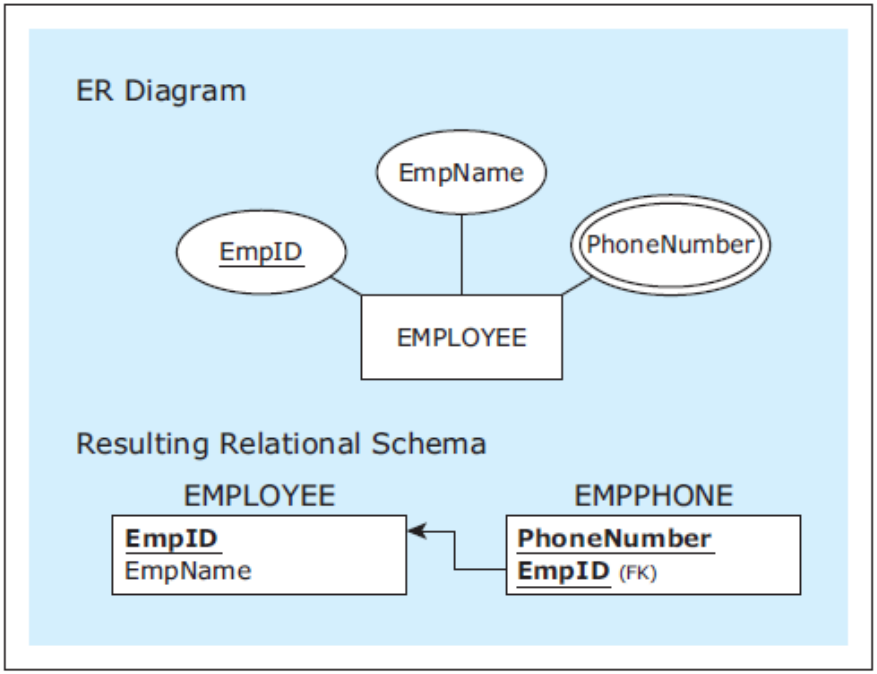
VIN	LPNumber	State	Make	Model	Year
11111	X123	IL	Ford	Fiesta	2012
22222	X456	IL	Ford	Escape	2009
33333	X123	MI	Chevrolet	Volt	2012

MAPPING MULTIVALUED ATTRIBUTES

- **Mapping entities with multivalued attributes into relational database constructs**
  - An entity containing the multivalued attribute is mapped without the multi-valued attribute
  - The multi-valued attribute is mapped as a separate relation that has a column representing the multivalued attribute and a foreign key column referring to the primary key of the relation resulting from the entity itself
    - Both of these columns form a composite primary key for the separate relation

MAPPING MULTIVALUED ATTRIBUTES

Entity with multivalued attributes mapped into relations



Sample data records for the mapped relations

EMPLOYEE

EmpID	EName
1234	Becky
2345	Molly
3456	Rob
1324	Ted

EMPPHONE

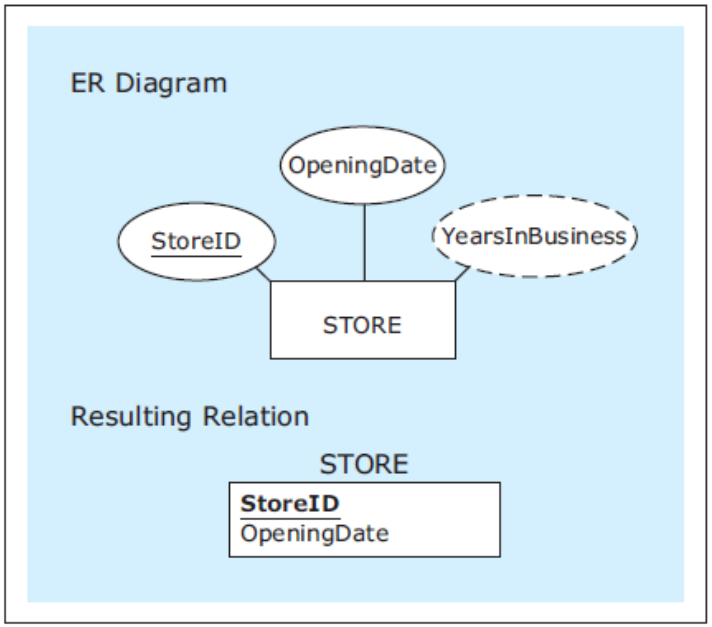
EmpID	PhoneNumber
1234	630-111-4567
1234	630-222-4567
2345	630-333-4567
3456	630-111-4567
3456	630-444-4567
1324	630-111-4567
1324	630-555-4567
1324	630-666-4567

MAPPING DERIVED ATTRIBUTES

- **Mapping derived attributes**
  - Derived attributes are not mapped as a part of the relational schema
  - They are implemented as a part of the database front-end application

MAPPING DERIVED ATTRIBUTES

Entity with derived attributes mapped into a relation



Sample data records for the mapped relation

STORE (RELATION)

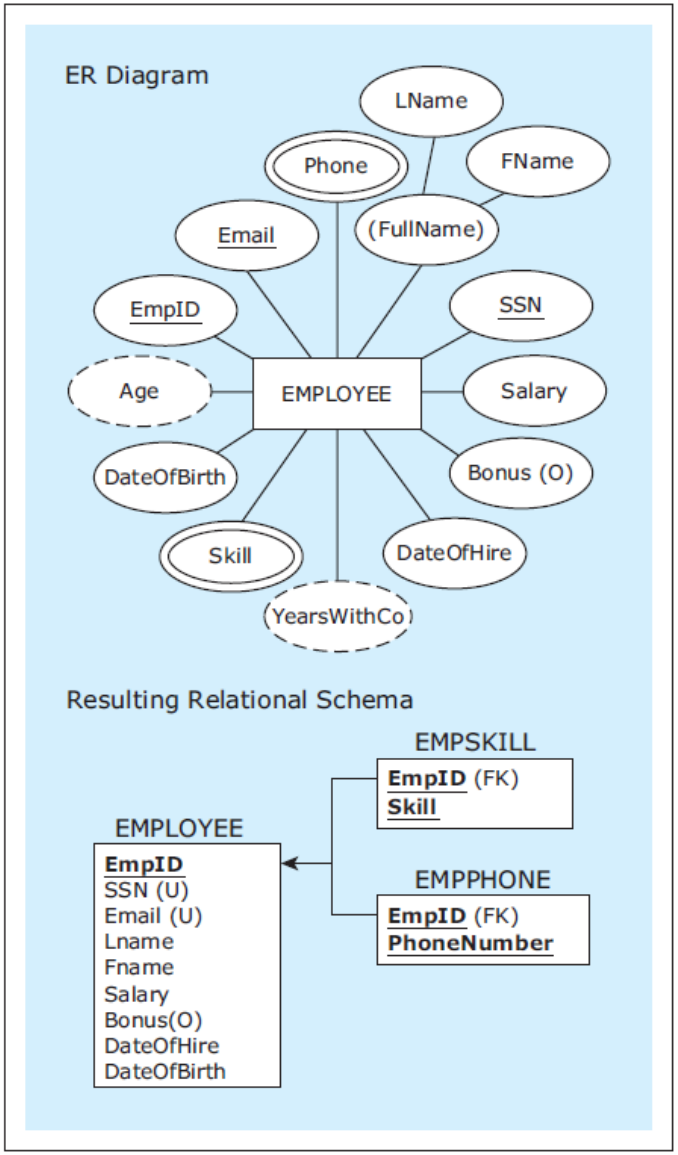
StoreID	OpeningDate
1111	1.1.2000
2222	2.2.2001
3333	3.3.2002
4444	2.2.2001

The relation shown as presented to a user in a front-end application

STORE

Sid	OpeningDate	YearsInBusiness
1111	1.1.2000	13
2222	2.2.2001	12
3333	3.3.2002	11
4444	2.2.2001	12

Example : Entity with various types of attributes mapped into a relation



Example : Sample data records for the mapped relations

EMPLOYEE

EmpID	SSN	Email	FName	LName	Salary	Bonus	DateOfHire	DateOfBirth
1234	111-11-1111	bk@compx.com	Becky	Kaiser	$75,000		1.1.2002	11.12.1970
2345	222-22-2222	mn@compx.com	Molly	Neps	$50,000	$10,000	2.2.2002	9.8.1973
3456	333-33-3333	rd@compx.com	Rob	Duzs	$55,000	$4,000	3.4.2003	11.11.1976
1324	444-44-4444	ti@compx.com	Ted	Lovett	$70,000		9.8.2004	5.6.1971

EMPPHONE

EmpID	PhoneNumber
1234	630-111-4567
1234	630-222-4567
2345	630-333-4567
3456	630-111-4567
3456	630-444-4567
1324	630-111-4567
1324	630-555-4567
1324	630-666-4567

EMPSKILL

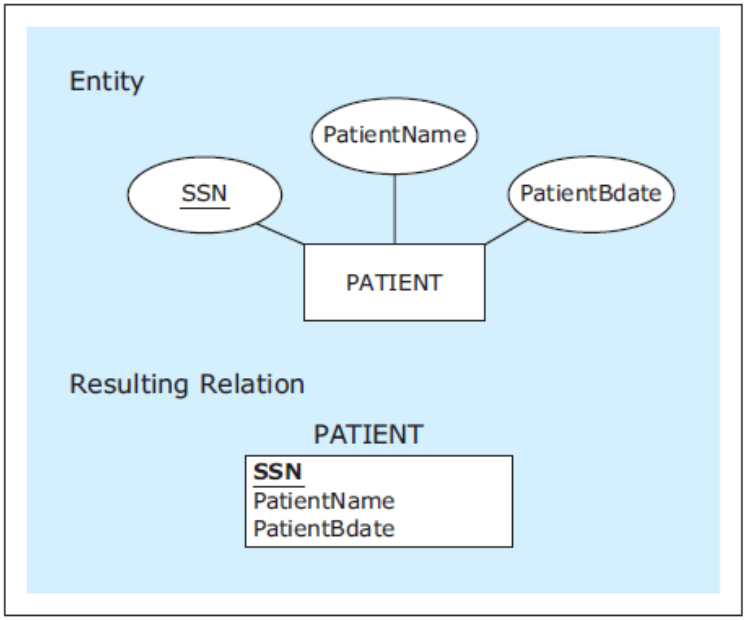
EmpID	Skill
1234	CPA
1234	CFP
2345	CPA
3456	CPA
3456	CFP
3456	CPP
1324	CFP

DESIGNER-CREATED PRIMARY KEYS AND THE AUTONUMBER OPTION

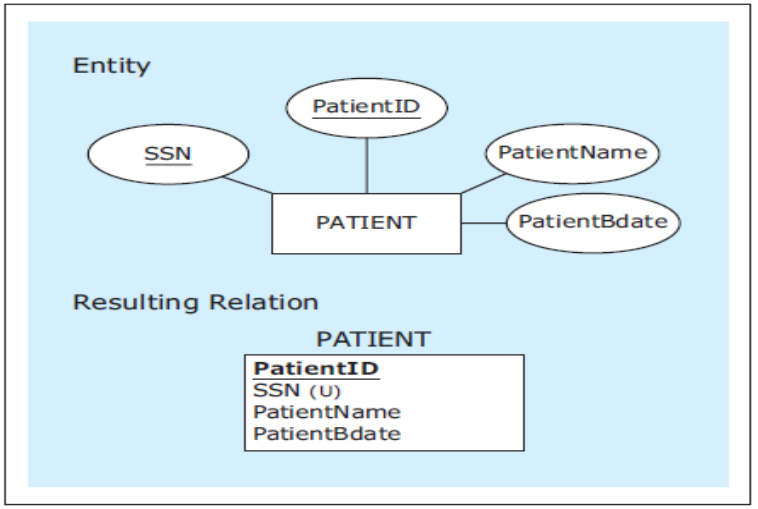
- **Autonumber data type option** - enables automatic generation of consecutive numeric data values in a column
- **Designer-created primary key** - primary key column, not called for by the original requirements, added to a table by the database designer
  - Often used in conjunction with the autonumber data type option

DESIGNER-CREATED PRIMARY KEYS AND THE AUTONUMBER OPTION

Entity and the resulting relation



Entity and the resulting relation with a designer-created primary key column



Sample data records for the relation with a designer-created primary key

PATIENT

PatientID	SSN	PatientName	PatientBdate
1	123-44-4444	Ernest	1/1/1929
2	567-88-8888	Hans	2/2/1931
3	912-33-3333	Sally	4/3/1951