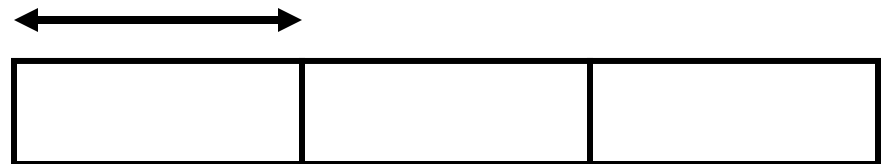
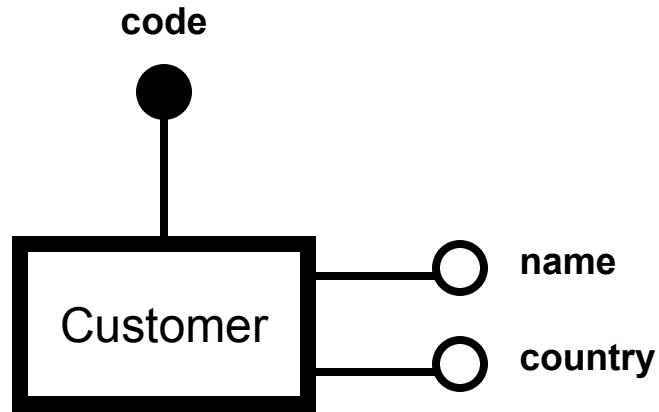


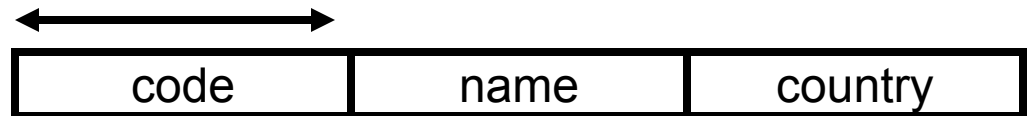
RELATIONAL DATABASE DESIGN



**Enterprise Model
(E-R Diagram)**



**Relational Database
Structure**



Definition of fields/attributes

Detailed definitions of fields/attributes (code)

Field Name	Data Type	Description
code	AutoNumber	
name	Text	
country	Text	

Field Properties	
General	
Field Size	Long Integer
New Values	Increment
Format	
Caption	
Indexed	Yes (No Duplicates)
Smart Tags	

1

Definition of Table Structure (Customer)

Table Structure

Instances

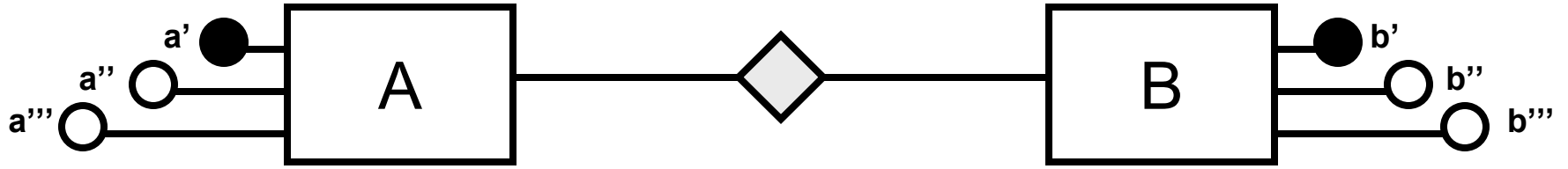
code	name	country
1	Michael Jordan	USA
2	Steffi Graf	Germany
3	Hilary Clinton	USA

Record: 3 of 3

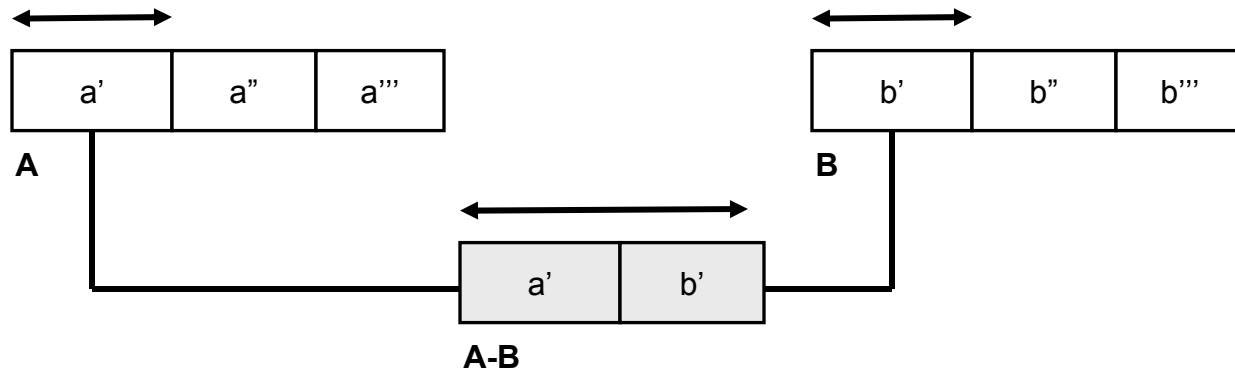
2

Table Structure (Customer)

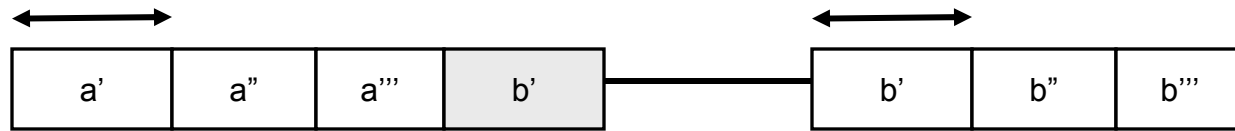
Mapping E-R relationships to Relational Databases



Solution 1

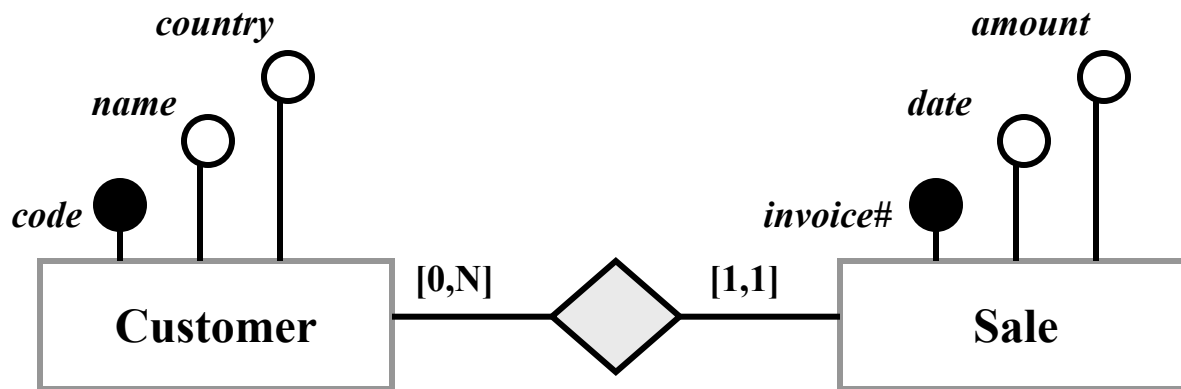


Solution 2



Solution 3





code	name	country
1	Michael Jordan	USA
2	Steffi Graf	Germany
3	Jerry Seinfeld	USA

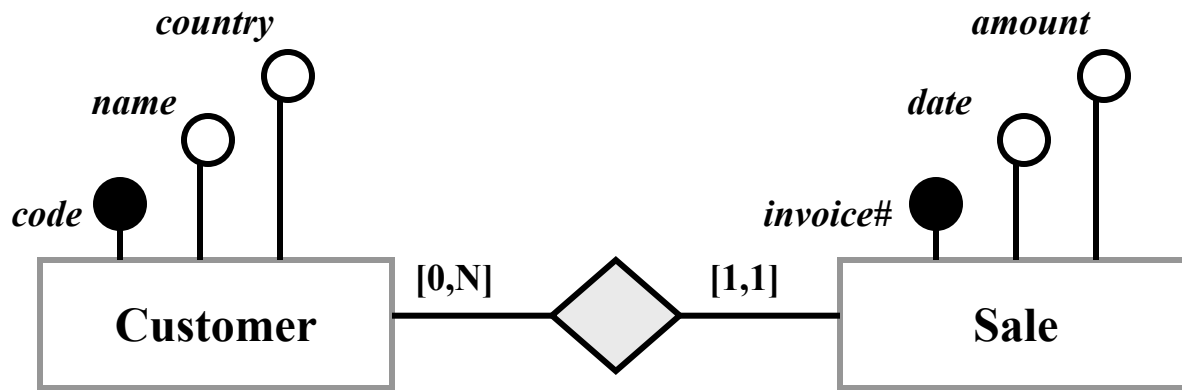
Customer



invoice#	date	amount
1	11/13/2004	\$125
2	11/13/2004	\$110
3	11/14/2004	\$80
4	11/14/2004	\$35
5	11/15/2004	\$40

Sale

How To Implement The Relationship Between Customer and Sale?



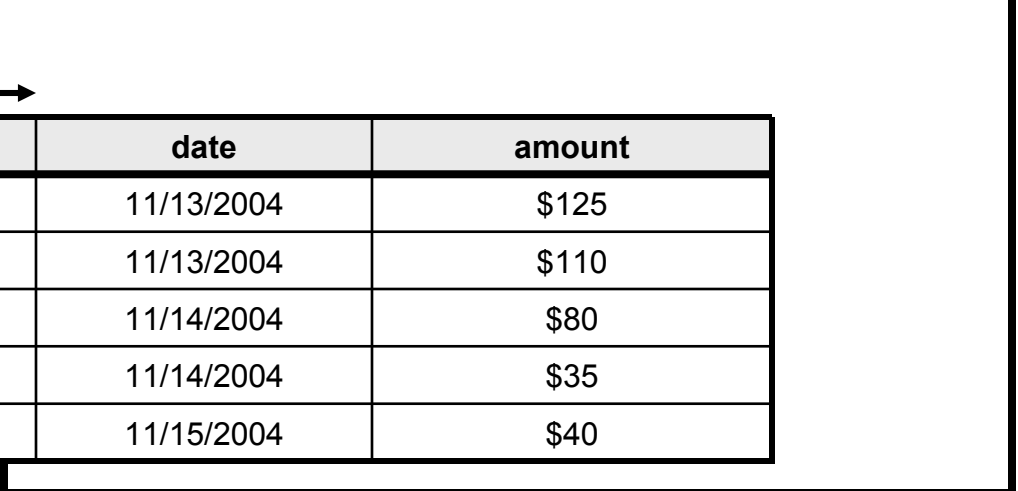
code	name	country	SALE
1	Michael Jordan	USA	1
1	Michal Jordan	USA	2
1	Michael Jordan	USA	4
2	Steffi Graf	Germany	3
2	Steffi Graf	Germany	5
3	Jerry Seinfeld	USA	null

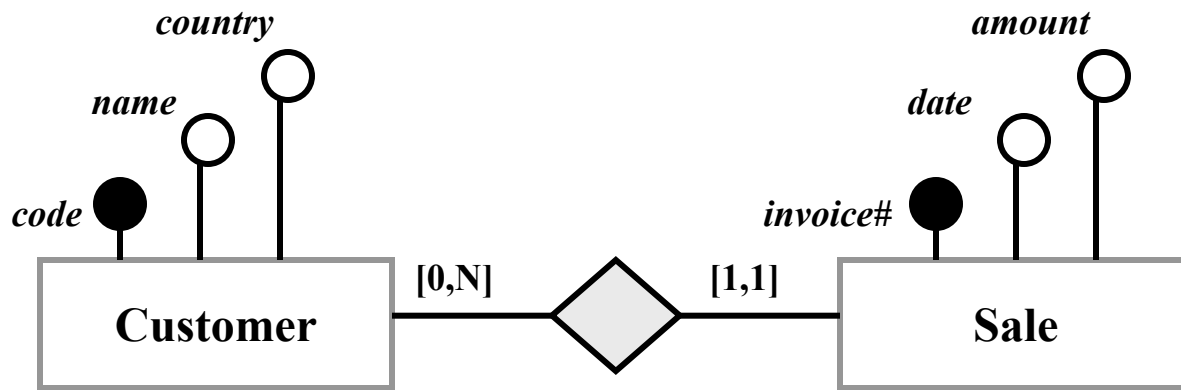
Customer



invoice#	date	amount
1	11/13/2004	\$125
2	11/13/2004	\$110
3	11/14/2004	\$80
4	11/14/2004	\$35
5	11/15/2004	\$40

Sale





←→

code	name	country
1	Michael Jordan	USA
2	Steffi Graf	Germany
3	Jerry Seinfeld	USA

Customer

←→

invoice#	date	amount	CUSTOMER
1	11/13/2004	\$125	1
2	11/13/2004	\$110	1
3	11/14/2004	\$80	2
4	11/14/2004	\$35	1
5	11/15/2004	\$40	2

Sale



code	name	country
1	Michael Jordan	USA
2	Steffi Graf	Germany
3	Jerry Seinfeld	USA

Customer

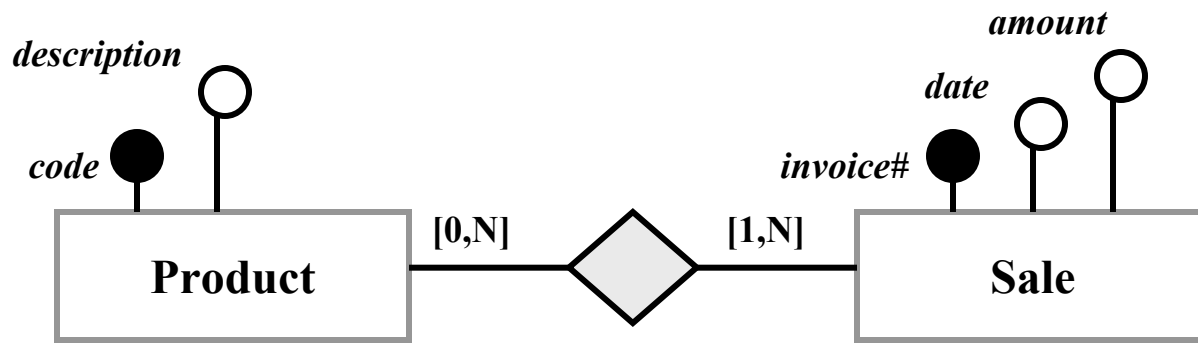


invoice#	date	amount	CUSTOMER
1	11/13/2004	\$125	1
2	11/13/2004	\$110	1
3	11/14/2004	\$80	2
4	11/14/2004	\$35	1
5	11/15/2004	\$40	2

Sale

== JOIN ==

name	country	code/CUSTOMER	invoice#	date	amount
Michael Jordan	USA	1	1	11/13/2004	\$125
Michal Jordan	USA	1	2	11/13/2004	\$110
Michael Jordan	USA	1	4	11/14/2004	\$80
Steffi Graf	Germany	2	3	11/14/2004	\$35
Steffi Graf	Germany	2	5	11/15/2004	\$40

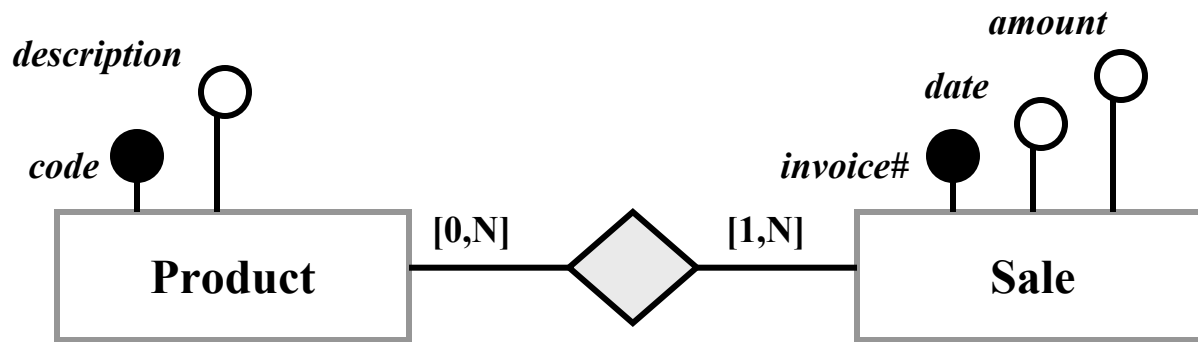


code	description	SALE
1	Rolls Royce Silver Shadow	1
1	Rolls Royce Silver Shadow	3
2	VW Beetle	1
2	VW Beetle	5
3	Jaguar Mark 10	2
4	Ford Mustang Classic	2
5	Citroen 2PK	4
6	Rolls Royce Phantom III	null
7	Volvo Classic	null

Product

invoice#	date	amount
1	11/13/2004	\$125
2	11/13/2004	\$110
3	11/14/2004	\$80
4	11/14/2004	\$35
5	11/15/2004	\$40

Sale

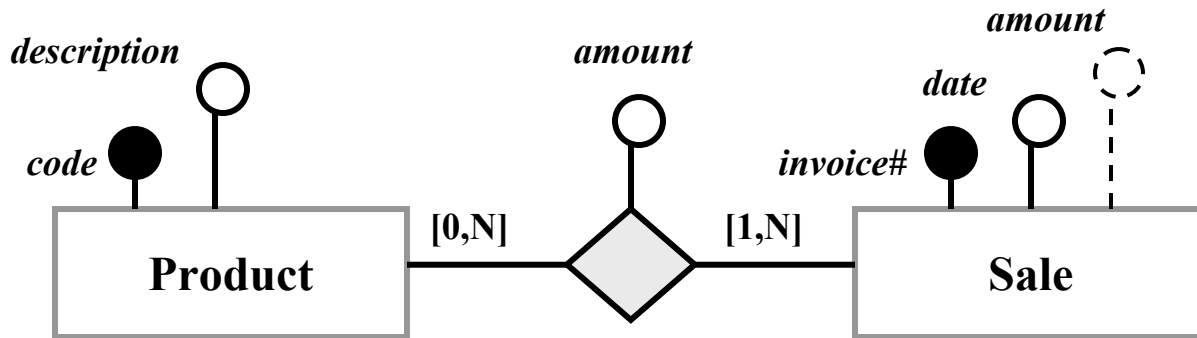


code	description
1	Rolls Royce Silver Shadow
2	VW Beetle
3	Jaguar Mark 10
4	Ford Mustang Classic
5	Citroen 2PK
6	Rolls Royce Phantom III
7	Volvo Classic

Product

invoice#	date	amount	PRODUCT
1	11/13/2004	\$125	1
1	11/13/2004	\$125	2
2	11/13/2004	\$110	3
2	11/13/2004	\$110	4
3	11/14/2004	\$80	1
4	11/14/2004	\$35	5
5	11/15/2004	\$40	2

Sale



←→

code	description
1	Rolls Royce Silver Shadow
2	VW Beetle
3	Jaguar Mark 10
4	Ford Mustang Classic
5	Citroen 2PK
6	Rolls Royce Phantom III
7	Volvo Classic

Product

←→

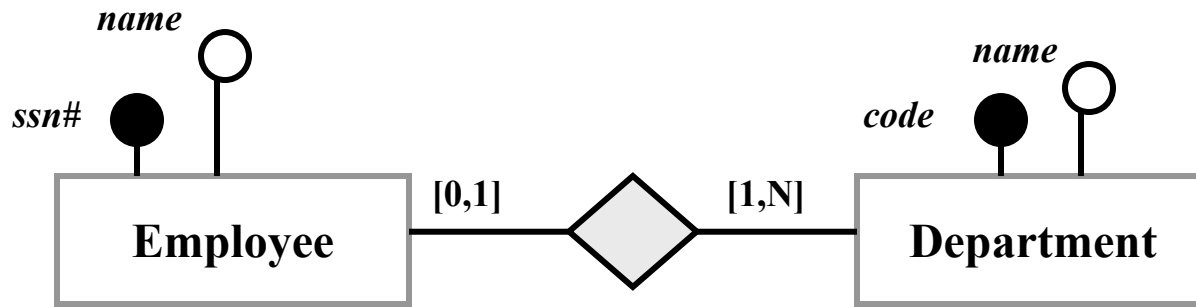
invoice#	date	amount
1	11/13/2004	\$125
2	11/13/2004	\$110
3	11/14/2004	\$80
4	11/14/2004	\$35
5	11/15/2004	\$40

Sale

←→

PRODUCT	SALE	amount
1	1	\$85
1	3	\$80
2	1	\$40
2	5	\$40
3	2	\$80
4	2	\$30
5	4	\$35

Product-Sale

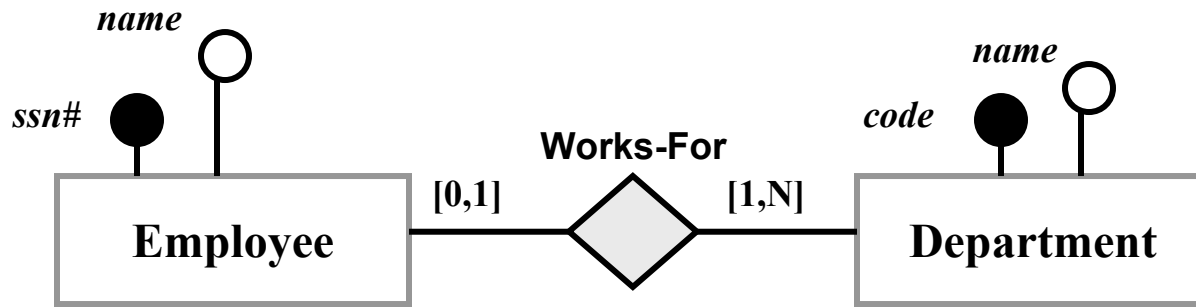


<i>ssn#</i>	<i>name</i>	<i>code</i>
1	Elvis Costello	1
2	Mick Jagger	null
3	Monica Bing	null
4	Van Morisson	null
5	Jackie Chan	null
6	Julia Roberts	null
7	Elvis Presley	null
8	Marion Jones	2
9	Ben Wallace	null
10	Jimmy Buffet	null

Employee

<i>code</i>	<i>name</i>
1	Accounting
2	Marketing

Department



ssn#	name
1	Elvis Costello
2	Mick Jagger
3	Monica Bing
4	Van Morisson
5	Jackie Chan
6	Julia Roberts
7	Elvis Presley
8	Marion Jones
9	Ben Wallace
10	Jimmy Buffet

Employee



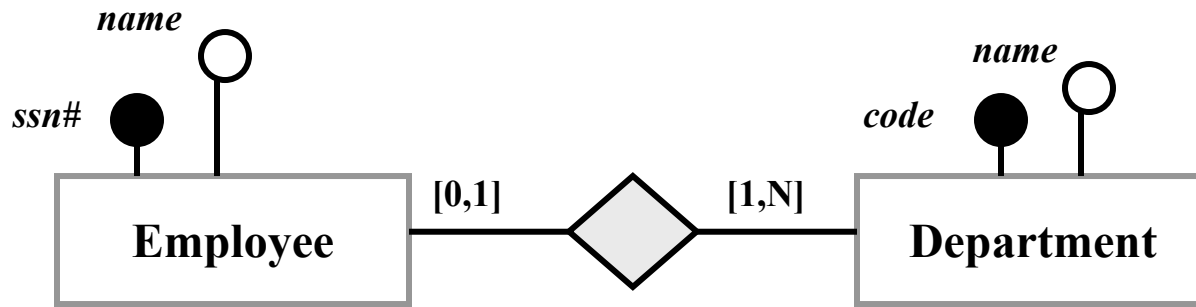
code	name
1	Accounting
2	Marketing

Department



ssn#	code
1	1
8	2

Works-For

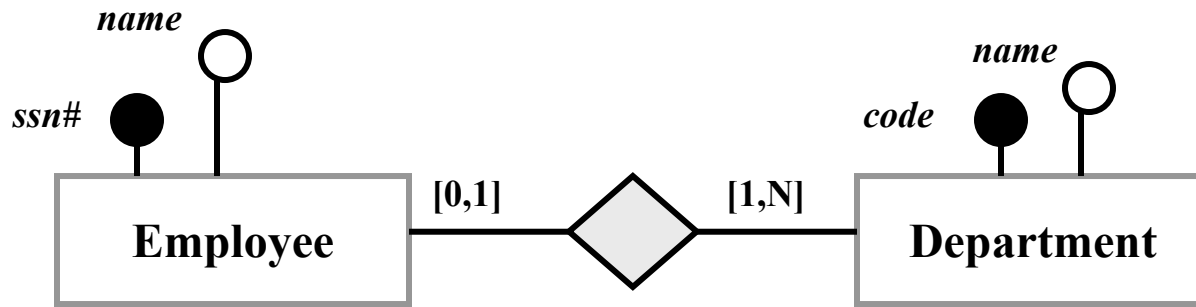


ssn#	name	code
1	Elvis Costello	1
2	Mick Jagger	3
3	Monica Bing	2
4	Van Morisson	null
5	Jackie Chan	3
6	Julia Roberts	1
7	Elvis Presley	2
8	Marion Jones	2
9	Ben Wallace	null
10	Jimmy Buffet	1

Employee

code	name
1	Accounting
2	Marketing
3	Purchase

Department



ssn#	name
1	Elvis Costello
2	Mick Jagger
3	Monica Bing
4	Van Morisson
5	Jackie Chan
6	Julia Roberts
7	Elvis Presley
8	Marion Jones
9	Ben Wallace
10	Jimmy Buffet

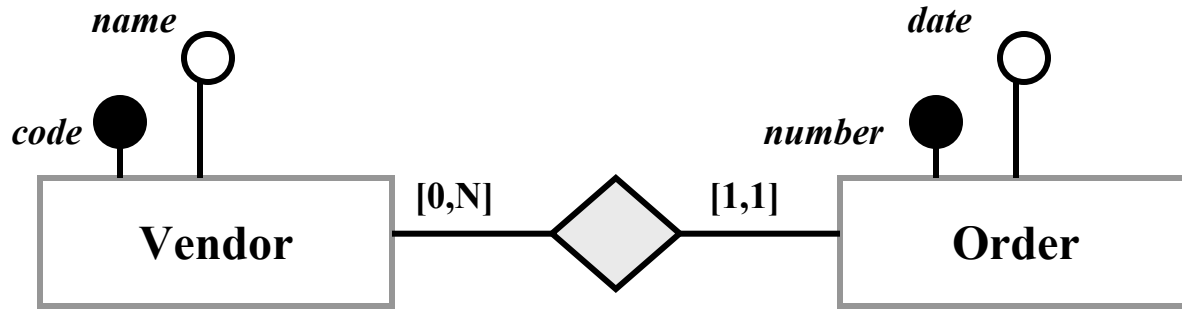
Employee

code	name
1	Accounting
2	Marketing
3	Purchase

Department

EMPLOYEE	DEPARTMENT
1	1
2	3
3	2
5	3
6	1
7	2
8	2
10	1

Works-For



Vendor

code	name	ORDER
1	Jimmy John	1
1	Jimmy John	2
1	Jimmy John	4
2	Pablo Picasso	3

Order

code	date
1	10/1/2004
2	10/5/2004
3	10/7/2004
4	10/8/2004

Solution A

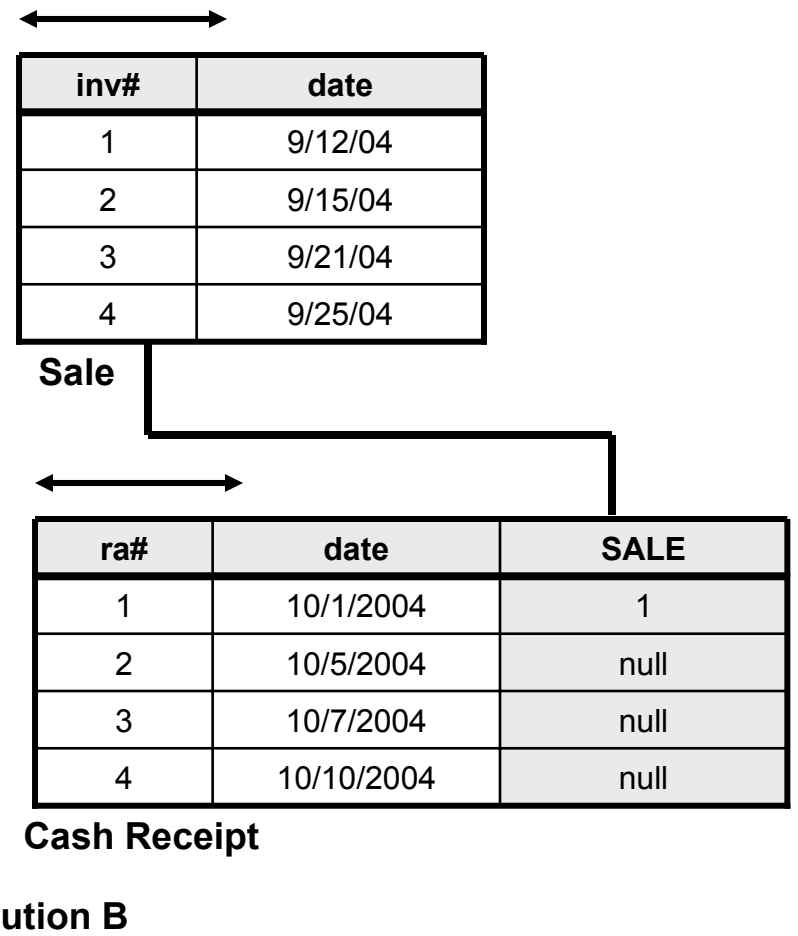
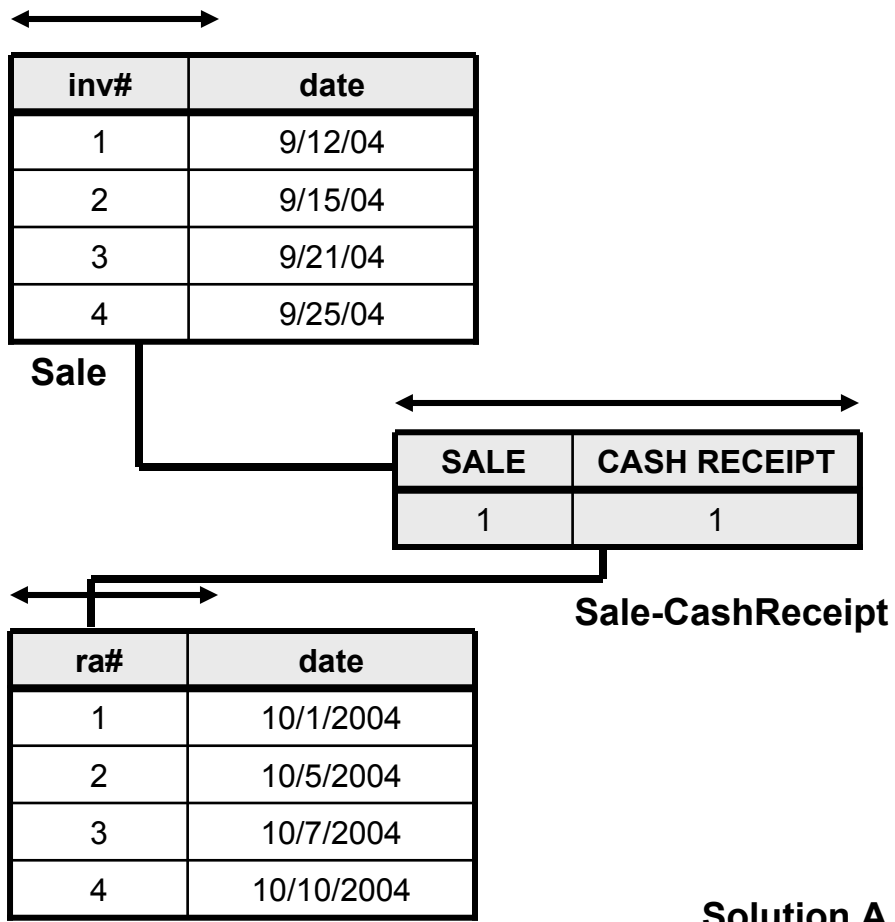
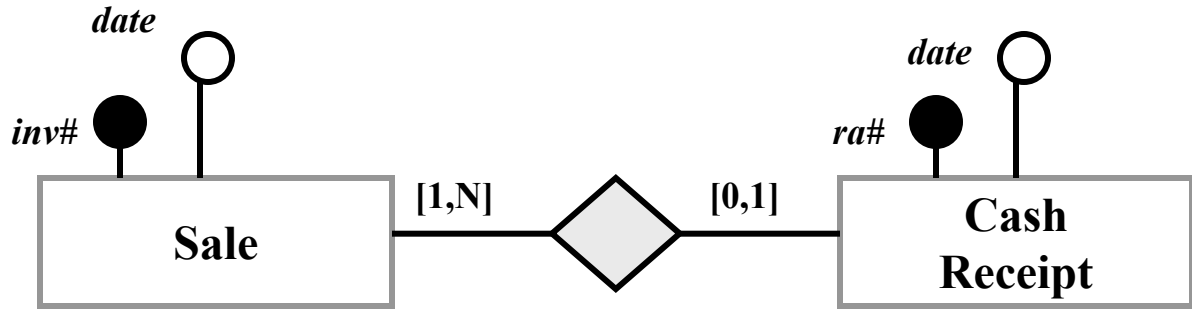
Vendor

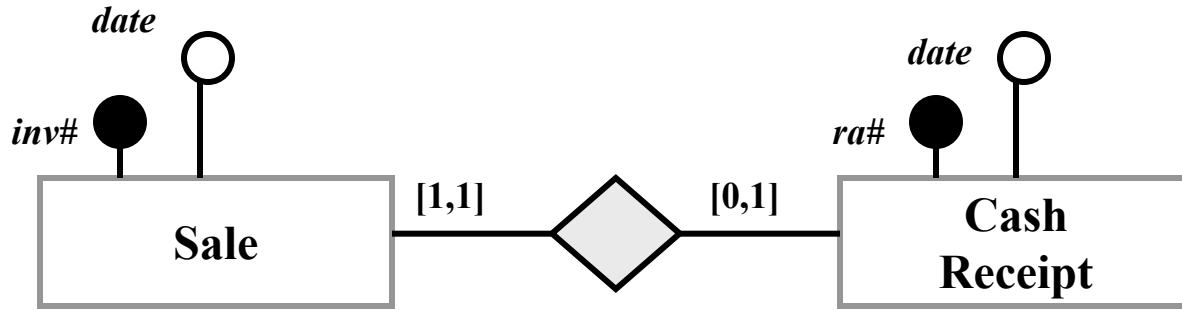
code	name
1	Jimmy John
2	Pablo Picasso

Order

code	date	VENDOR
1	10/1/2004	1
2	10/5/2004	1
3	10/7/2004	2
4	10/8/2004	1

Solution B





↔

inv#	date	CASH RECEIPT
1	9/12/04	1
2	9/15/04	2
3	9/16/04	3

Sale

↔

ra#	date
1	10/1/2004
2	10/5/2004
3	10/7/2004
4	10/10/2004

Cash Receipt

Solution A

↔

inv#	date
1	9/12/04
2	9/15/04
3	9/16/04

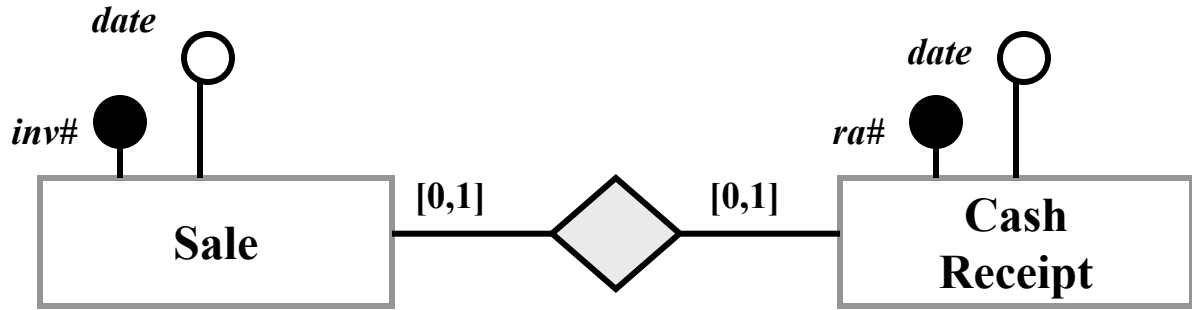
Sale

↔

ra#	date	SALE
1	10/1/2004	1
2	10/5/2004	2
3	10/7/2004	3
4	10/10/2004	null

Cash Receipt

Solution B



↔

Sale

inv#	date
1	9/12/04
2	9/15/04
3	9/21/04
4	9/25/04

↔

ra#	date	SALE
1	10/1/2004	1
2	10/5/2004	2
3	10/7/2004	3
4	10/10/2004	null

Cash Receipt

HEURISTICS SUMMARY

I



Many-to-Many Relationships

RULE

Represent relationship with separate table.
To avoid REDUNDANCY.
No exceptions.

II



One-to-Many Relationships

RULE

Post the key of the “many” entity as a foreign key into the “one” entity.
To avoid REDUNDANCY.

EXCEPTION

IF the “One” entity is optional and Low Load (LL)
THEN represent relationship with separate table.
To avoid LOAD issues

III



One-to-One Relationships

RULE

Post the foreign key in the (1,1) (Min,Max) Entity – Patterns 1,2,3 below
To avoid LOAD issues

Pattern 1: Entity-1 (1,1) -- (1,1) Entity-2

Post foreign key (either way)

Pattern 2: Entity-1 (1,1) -- (0,1) Entity-2

Post primary key of Entity-2 as foreign key in Entity-1

Pattern 3: Entity-1 (0,1) -- (1,1) Entity-2

Post primary key of Entity-1 as foreign key in Entity-2

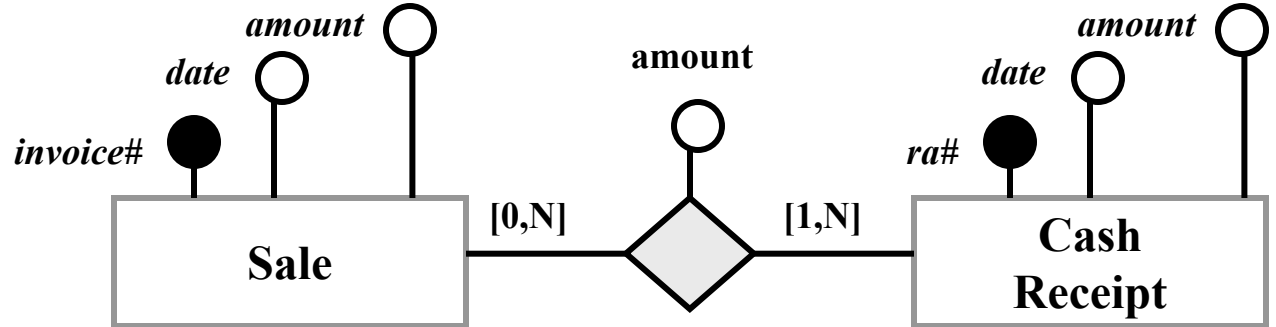
Pattern 4: Entity-1 (0,1) -- (0,1) Entity-2

- | | | | |
|----|----|---|---------------------|
| HL | HL | → | FK in Highest Load |
| HL | LL | → | FK in Entity 1 (HL) |
| LL | HL | → | FK in Entity 2 (HL) |
| LL | LL | → | Separate Table |

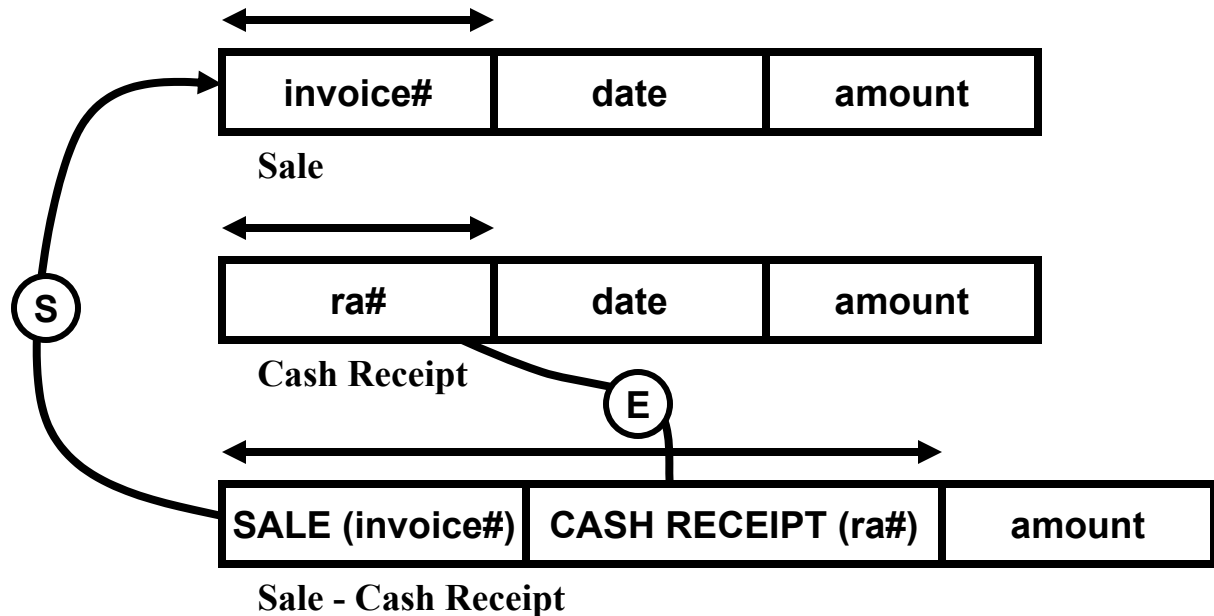
Pattern I: N-N Relationship

Rule: Separate Table

Example



Solution



Pattern I: N-N Relationship

Rule: Separate Table

Tables

INVOICE#	DATE	AMOUNT
0001	9/7/2008	\$125.00
0002	9/7/2008	\$110.00
0003	9/8/2008	\$80.00
0004	9/8/2008	\$35.00
0005	9/9/2008	\$40.00

Sale

RA#	DATE	AMOUNT
0001	9/8/2008	\$125.00
0002	9/10/2008	\$100.00

Cash Receipt

SALE (INVOICE#)	CASH RECEIPT (RA#)	AMOUNT
0001	0001	\$125.00
0003	0002	\$60.00
0005	0002	\$40.00

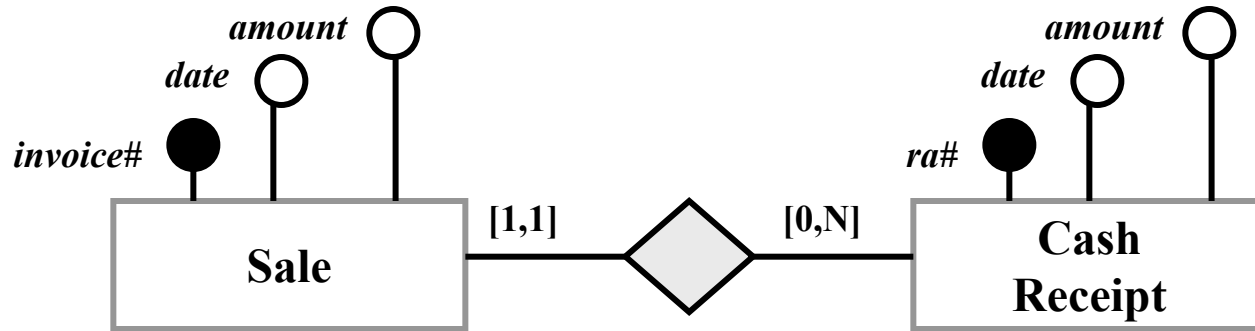
Sale - Cash Receipt

S

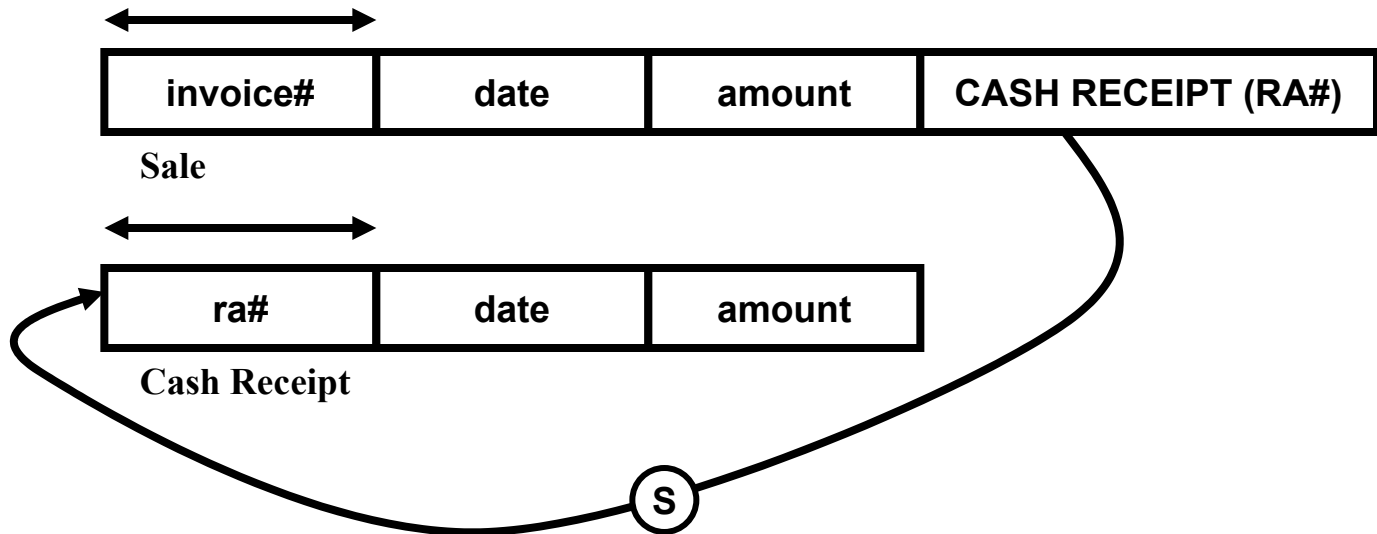
E

Pattern II: 1-N Relationship Rule: Foreign Key in "1" Table

Example



Solution



Pattern II: 1-N Relationship Rule: Foreign Key in "1" Table

Tables

INVOICE#	DATE	AMOUNT	CASH RECEIPT (RA#)
0001	9/7/2008	\$125.00	0001
0002	9/7/2008	\$110.00	0002
0003	9/8/2008	\$80.00	0003
0004	9/8/2008	\$35.00	0005
0005	9/9/2008	\$40.00	0006

Sale

RA#	DATE	AMOUNT
0001	9/8/2008	\$125.00
0002	9/8/2008	\$110.00
0003	9/9/2008	\$80.00
0004	9/9/2008	\$66.00
0005	9/9/2008	\$35.00
0006	9/10/2008	\$40.00

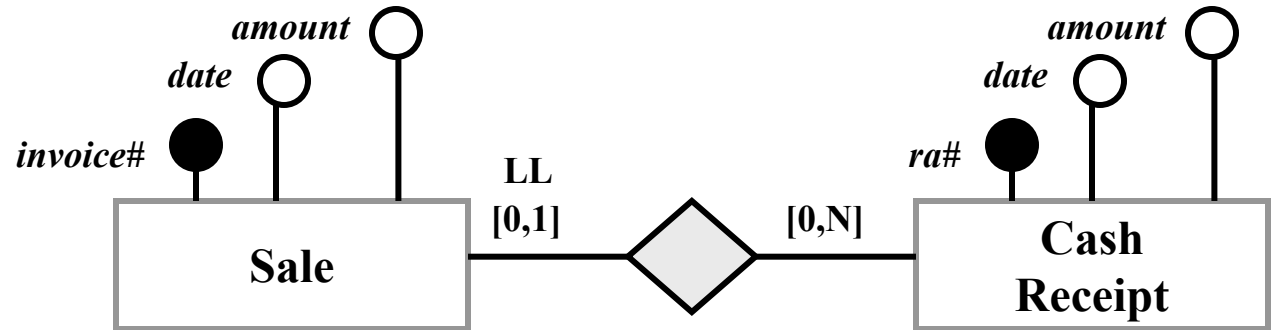
Cash Receipt

S

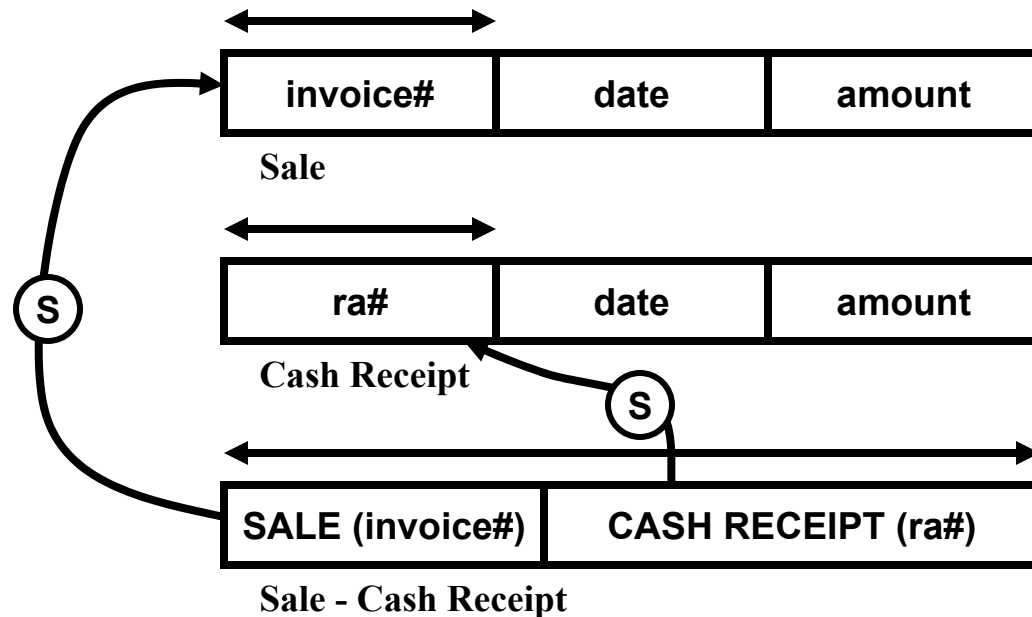
Pattern II: 1-N Relationship

Exception: IF the “One” entity is optional and Low Load (LL) THEN represent relationship with separate table.

Example



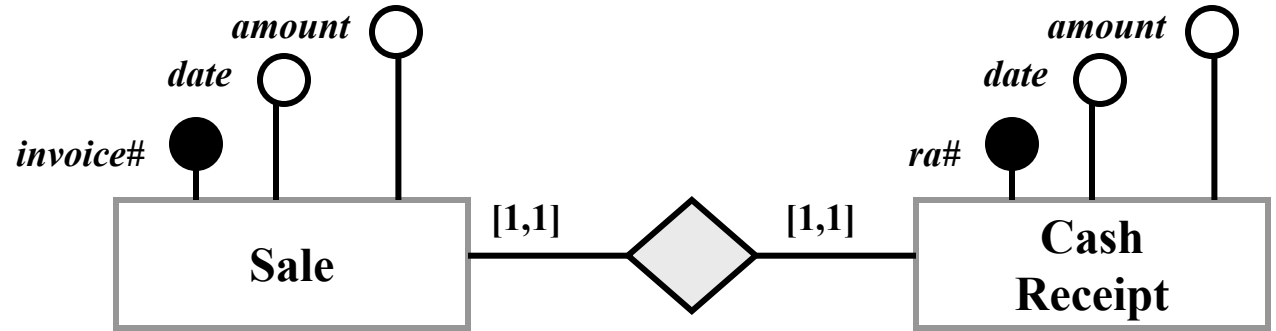
Solution



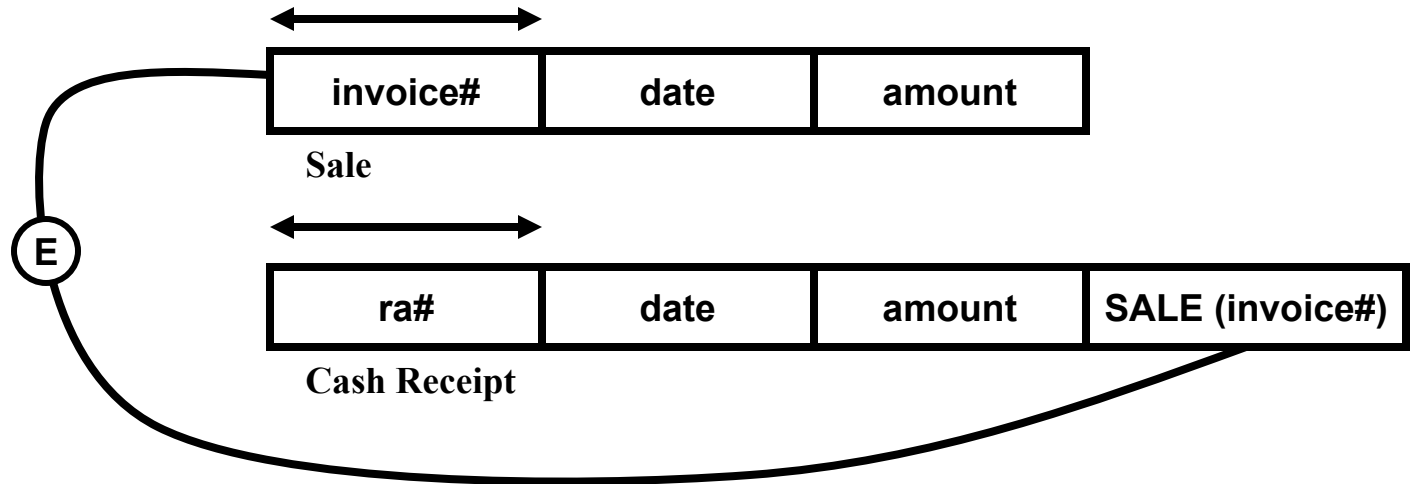
Pattern III: 1-1 Relationship

Rule: Foreign Key in (1,1) Table

Example



Solution



Pattern III: 1-1 Relationship

Rule: Foreign Key in (1,1) Table

Tables

INVOICE#	DATE	AMOUNT
0001	9/7/2008	\$125.00
0002	9/7/2008	\$110.00
0003	9/8/2008	\$80.00
0004	9/8/2008	\$35.00
0005	9/9/2008	\$40.00

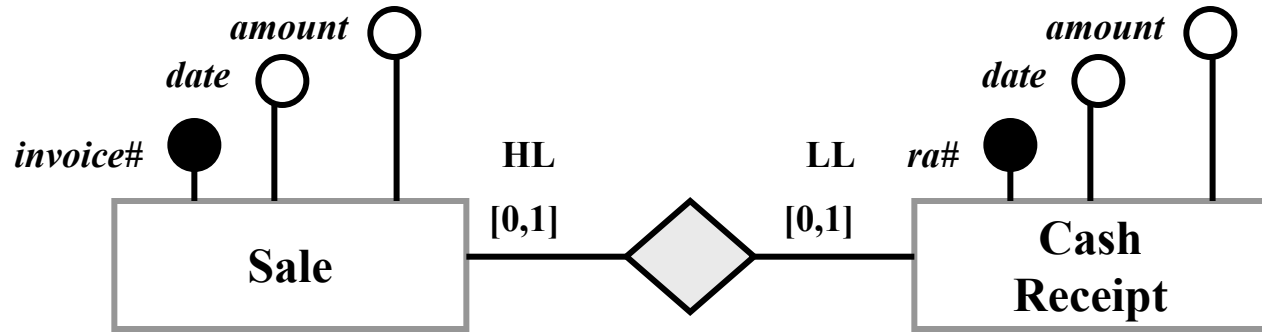
Sale

RA#	DATE	AMOUNT	SALE (Invoice#)
0001	9/8/2008	\$125.00	0001
0002	9/8/2008	\$110.00	0002
0003	9/9/2008	\$80.00	0003
0004	9/9/2008	\$35.00	0004
0005	9/9/2008	\$40.00	0005

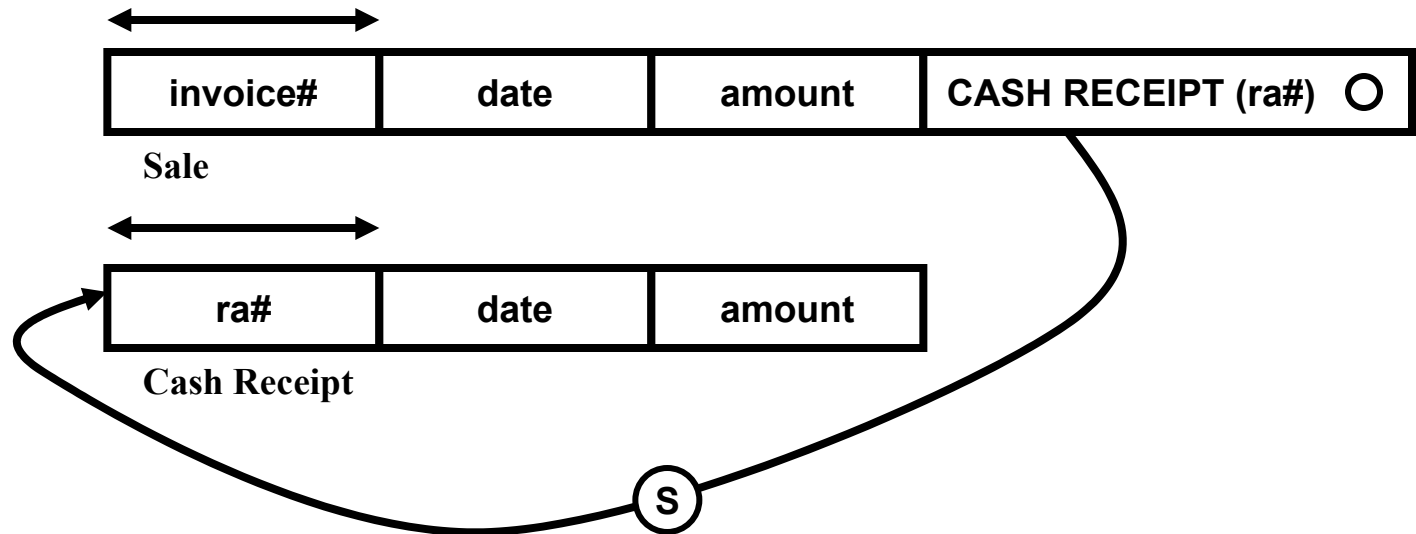
Cash Receipt

Pattern III: (0,1)-(0,1) Relationship HL -- LL

Example



Solution



Pattern III: (0,1)-(0,1) Relationship HL -- LL

Tables

INVOICE#	DATE	AMOUNT	CASH RECEIPT (RA#)
0001	9/7/2008	\$125.00	0001
0002	9/7/2008	\$110.00	0002
0003	9/8/2008	\$80.00	0003
0004	9/8/2008	\$35.00	null
0005	9/9/2008	\$40.00	null

Sale

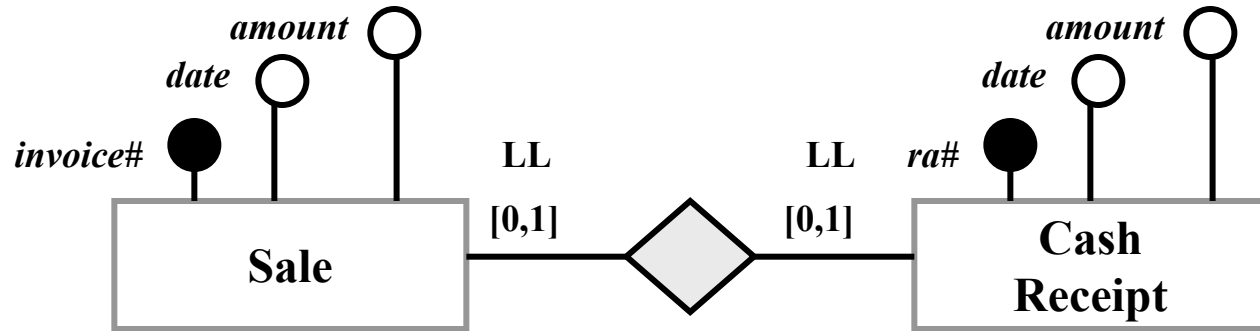
RA#	DATE	AMOUNT
0001	9/8/2008	\$125.00
0002	9/8/2008	\$110.00
0003	9/9/2008	\$80.00
0004	9/9/2008	\$66.00
0005	9/9/2008	\$50.00
0006	9/10/2008	\$70.00

Cash Receipt

S

Pattern III: (0,1)-(0,1) Relationship LL -- LL

Example



Solution

