

Modelo EA (*EER*) → Relacional → Físico

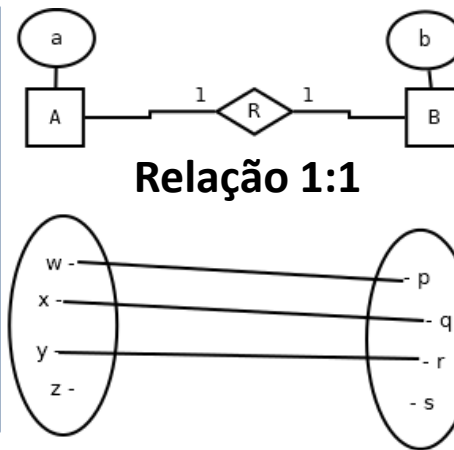
Vitor Vaz da Silva

A(a,b) cc={{a}} ce={{b}} b:B(b)
B(b) cc={{b}}

create table B (b char primary key);
create table A (a char primary key,
b char **unique null**,
foreign key(b) references B(b));

A	<u>a</u>	b
	w	p
	x	q
	y	r
	z	r [§]
	u	

B	<u>b</u>
	p
	q
	r
	s



A	<u>a</u>	B	<u>b</u>	a
	w		p	w
	x		q	x
	y		r	y
	z		s	y [§]
			t	

A(a) cc={{a}}
B(b) cc={{b}}
A_B(a,b) cc={{a}, {b}} ce={{a},{b}} a:A(a), b:B(b)

Modelo Relacional

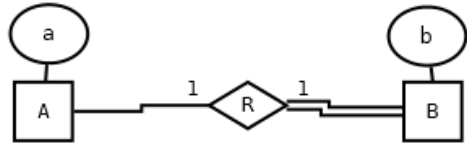
create table A (a char primary key);
create table B (b char primary key,
a char **unique null**,
foreign key(a) references A(a));

create table A (a char primary key);
create table B (b char primary key);
create table A_B (b char,
a char primary key,
foreign key(a) references A(a),
foreign key(b) references B(b));

A	<u>a</u>	B	<u>b</u>	A_B	<u>a</u>	b
	w		p		w	p
	x		q		x	q
	y		r		y	r
	z		s			

A(a) cc={{a}}
B(b,a) cc={{b}} ce={{a}} a:A(a)

[§] Indicar coluna **UNIQUE** e **NULL**



Relação 1:1

A(a) cc={{a}}
 B(b,a) cc={{b}} ce={{a}} a:A(a)

create table A (a char primary key);
 create table B (b char,
 a char **unique not null**,
 foreign key(a) references A(a),
 primary key(a,b));

Modelo Físico

A	<u>a</u>	B	<u>b</u>	a
	w		p	w
	x		q	x
	y		r	y
	z		t	y [§]

[§] Indicar coluna **UNIQUE** e **NOT NULL**

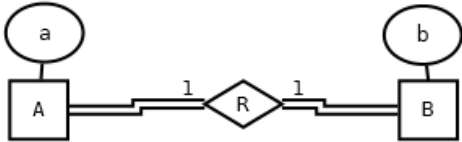
A(a) cc={{a}}
 B(b) cc={{b}}
 A_B(a,b) cc={{b}} ce={{a},{b}} a:A(a), b:B(b)

Modelo Relacional

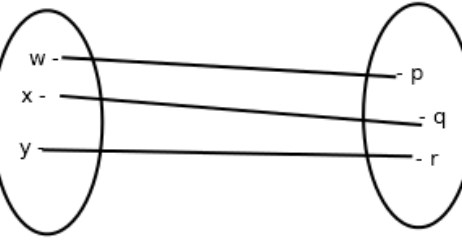
A	<u>a</u>	B	<u>b</u>	A_B	<u>a</u>	<u>b</u>
	w		p		w	p
	x		q		x	q
	y		r		y	r
	z					

Modelo Físico

create table A (a char primary key);
 create table B (b char primary key);
 create table A_B (a char,
 b char primary key,
 foreign key(a) references A(a),
 foreign key(b) references B(b));



Relação 1:1



A(a) cc={{a}}
 B(b,a) cc={{b}} ce={{a}} a:A(a)

create table A (a char primary key);
 create table B (b char,
 a char unique not null,
 foreign key(a) references A(a),
 primary key(a,b));

Modelo Físico

A	<u>a</u>	B	<u>b</u>	a
	w		p	w
	x		q	x
	y		r	y
	z		t	y [§]

[§] Indicar coluna UNIQUE e NOT NULL

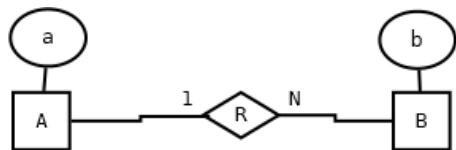
A(a) cc={{a}}
 B(b) cc={{b}}
 A_B(a,b) cc={{a},{b}} ce={{a},{b}} a:A(a), b:B(b)

Modelo Relacional

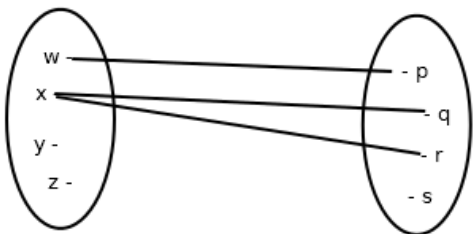
A	<u>a</u>	B	<u>b</u>	A_B	<u>a</u>	<u>b</u>
	w		p		w	p
	x		q		x	q
	y		r		y	r

create table A (a char primary key);
 create table B (b char primary key);
 create table A_B (a char **unique**,
 b char primary key,
 foreign key(a) references A(a));

Modelo Físico



Relação 1:N



A	<u>a</u>	B	<u>b</u>	A_B	<u>a</u>	<u>b</u>
	w		p		w	p
	x		q		x	q
	y		r		x	r
	z		s			

Modelo Físico

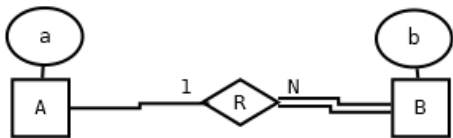
A(a) cc={{a}}
 B(b) cc={{b}}
 A_B(a,b) cc={{a},{b}} ce={{a},{b}} a:A(a), b:B(b)

Modelo Relacional
 A(a) cc={{a}}
 B(a,b) cc={{b}} ce={{a},{b}} a:A(a), b:B(b)

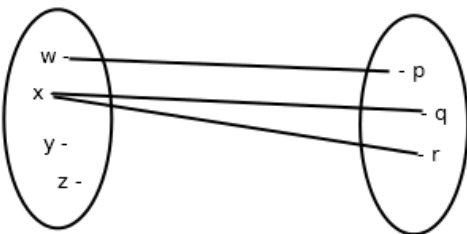
A	<u>a</u>	B	<u>b</u>	a
	w		p	w
	x		q	x
	y		r	x
	z		s	

create table A (a char primary key);
 create table B (
 b char primary key,
 a char **null**,
 foreign key(a) references A(a)
);

create table A (a char primary key);
 create table B (b char primary key);
 create table A_B (b char,
 a char **not null**,
 foreign key(a) references A(a),
 foreign key(b) references B(b),
 primary key(b));



Relação 1:N



$A(a)$ $cc=\{\{a\}\}$ **Modelo Relacional**
 $B(a,b)$ $cc=\{\{b\}\}$ $ce=\{\{a\}\}$ $a:A(a)$

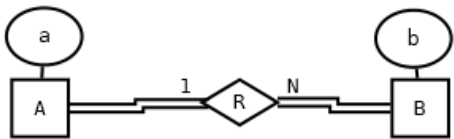
Modelo Físico

A	<u>a</u>	B	<u>b</u>	a
	w		p	w
	x		q	x
	y		r	x
	z			

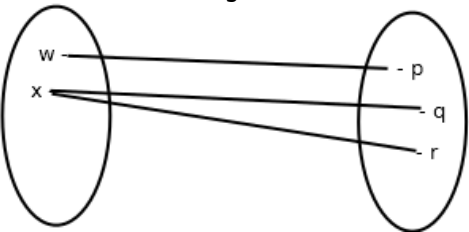
```

create table A (a char primary key);

create table B (
  b char primary key,
  a char not null,
  foreign key(a) references A(a)
);
  
```



Relação 1:N



A	<u>a</u>	B	<u>b</u>	a
	w		p	w
	x		q	x
	u[§]		r	x

$A(a)$ $cc=\{\{a\}\}$ **Modelo Relacional**
 $B(a,b)$ $cc=\{\{b\}\}$ $ce=\{\{a\},\{b\}\}$ $a:A(a), b:B(b)$

Modelo Físico

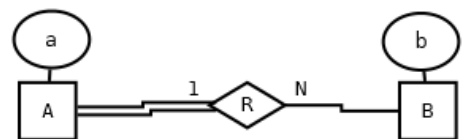
```

create table A (a char primary key);

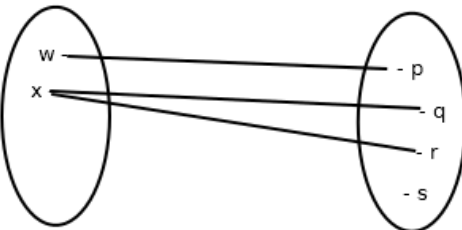
create table B (
  b char primary key,
  a char not null,
  foreign key(a) references A(a)
);

```

**§ Não é possível assegurar a participação obrigatória do lado 1 pelo esquema relacional;
É necessário processamento adicional**



Relação 1:N



A	<u>a</u>	B	<u>b</u>	a
	w		p	w
	x		q	x
	u [§]		r	x

**§ Não é possível assegurar a participação obrigatória do lado 1;
É necessário processamento adicional**

Modelo Físico

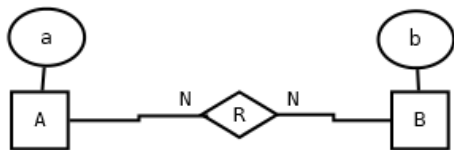
A(a) cc={{a}} **Modelo Relacional**
B(a,b) cc={{b}} ce={{a},{b}} a:A(a), b:B(b)

A(a) cc={{a}} **Modelo Relacional**
B(a,b) cc={{b}} ce={{a},{b}} a:A(a), b:B(b)

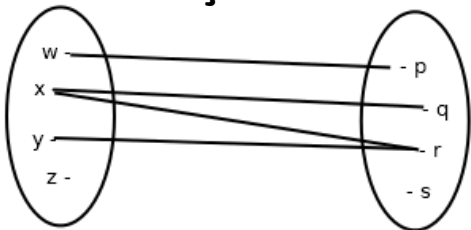
A	<u>a</u>	B	<u>b</u>	a
	w		p	w
	x		q	x
	u [§]		r	x
			s	

create table A (a char primary key);
create table B (
b char primary key,
a char **null**,
foreign key(a) references A(a)
);

create table A (a char primary key);
create table B (
b char primary key,
a char **not null**,
foreign key(a) references A(a)
);



Relação N:N



A	<u>a</u>	B	<u>b</u>	A_B	<u>a</u>	<u>b</u>
	w		p		w	p
	x		q		x	q
	y		r		x	r
	z		s		y	r

$A(a) \quad cc=\{\{a\}\}$
 $B(b) \quad cc=\{\{b\}\}$
 $A_B(a,b) \quad cc=\{\{a,b\}\} \quad ce=\{\{a\},\{b\}\} \quad a:A(a), b:B(b)$

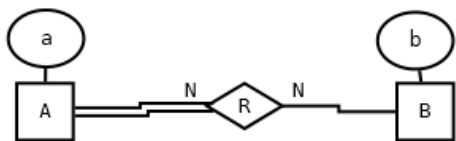
Modelo Físico

```

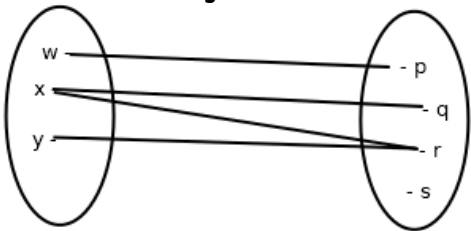
create table A (a char primary key);

create table B (b char primary key);

create table A_B (
  b char not null,
  a char not null,
  foreign key(a) references A(a),
  foreign key(b) references B(b),
  primary key(a,b)
);
  
```



Relação N:N



A	<u>a</u>	B	<u>b</u>	A_B	<u>a</u>	<u>b</u>
	w		p		w	p
	x		q		x	q
	y		r		x	r
	u [§]		s		y	r

Modelo Físico

A(a) cc={{a}}

B(b) cc={{b}}

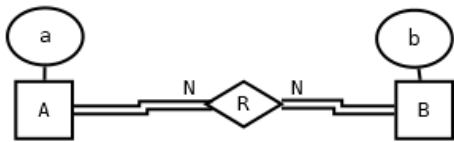
A_B(a,b) cc={{a,b}} ce={{a},{b}} a:A(a), b:B(b)

create table A (a char primary key);

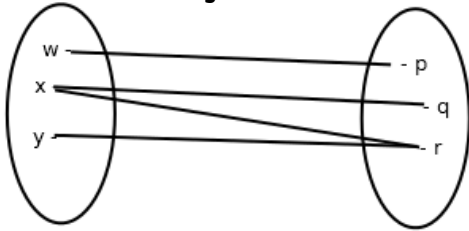
create table B (b char primary key);

create table A_B (b char **not null**,
a char **not null**,
foreign key(a) references A(a),
foreign key(b) references B(b),
primary key(a,b)
);

**§ Não é possível assegurar a participação obrigatória pelo esquema relacional;
É necessário processamento adicional**



Relação N:N



A	<u>a</u>	B	<u>b</u>	A_B	<u>a</u>	<u>b</u>
	w		p		w	p
	x		q		x	q
	y		r		x	r
	u [§]		t [§]		y	r

Modelo Físico

$A(a) \quad cc=\{\{a\}\}$
 $B(b) \quad cc=\{\{b\}\}$
 $A_B(a,b) \quad cc=\{\{a,b\}\} \quad ce=\{\{a\},\{b\}\} \quad a:A(a), b:B(b)$

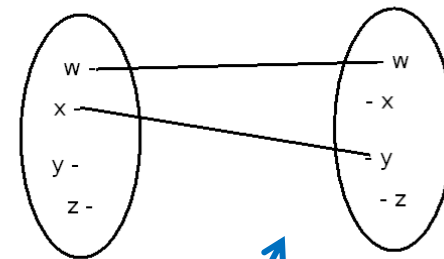
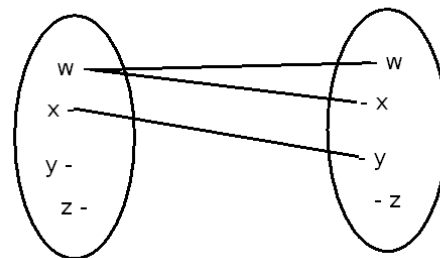
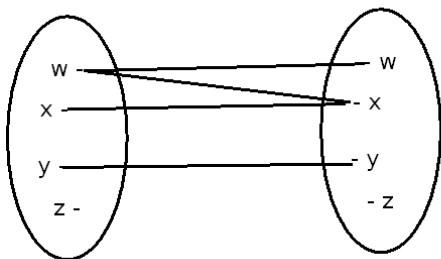
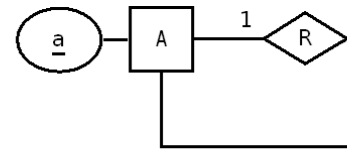
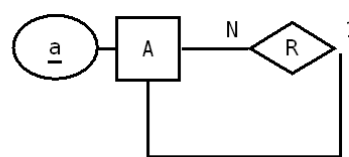
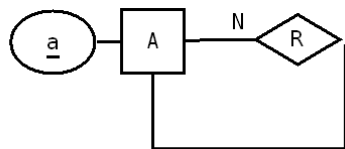
create table A (a char primary key);

create table B (b char primary key);

create table A_B (b char **not null**,
 a char **not null**,
 foreign key(a) references A(a),
 foreign key(b) references B(b),
primary key(a,b)
);

[§] Não é possível assegurar a participação obrigatória pelo esquema relacional;
 É necessário processamento adicional

Unário



$A(a) \text{ cc}=\{\{a\}\}$
 $A_A(a_1, a_2) \text{ cc}=\{\{a_1, a_2\}\}$
 $\text{ce}=\{\{a_1\}, \{a_2\}\}$

```

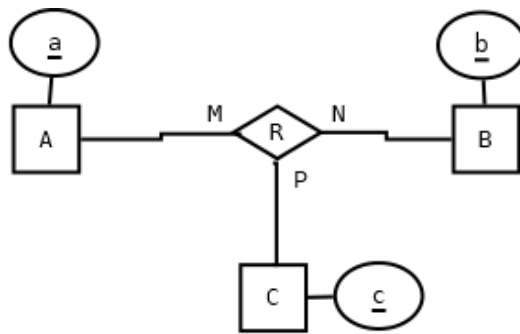
create table A (a char primary key);
create table A (
  a_1 char, a_2 char,
  foreign key(a_1) references A(a),
  foreign key(a_2) references A(a),
  primary key (a_1, a_2)
);
    
```

$A(a, a_1) \text{ cc}=\{\{a\}, \{a_1\}\}$
 $\text{ce}=\{\{a_1\}\}$

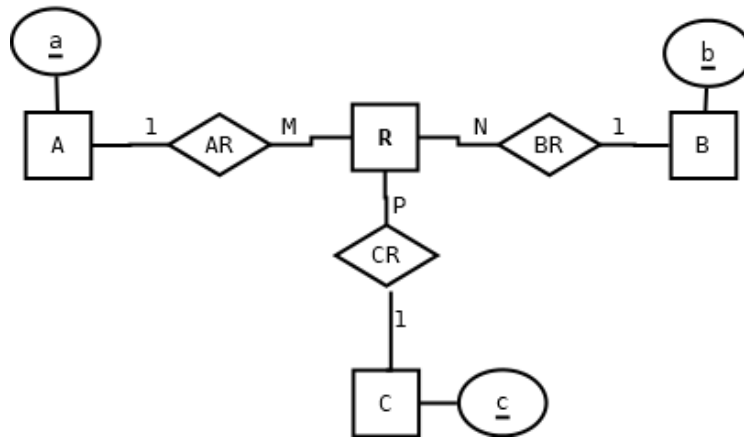
```

create table A (
  a char, a_1 char unique,
  foreign key(a_1) references A(a),
  primary key (a)
);
    
```

N-ário

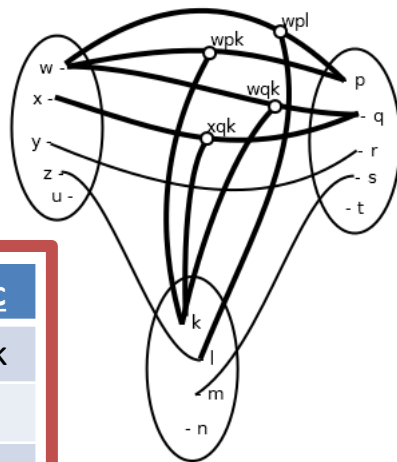
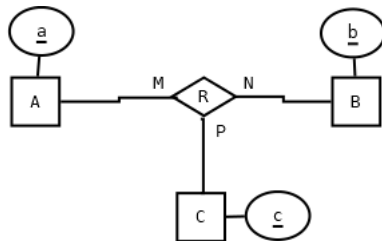


***N-ário* → Binário**



A(a) cc={{a}}
 B(b) cc={{b}}
 C(c) cc={{c}}

A_B_C(a,b,c)
 cc={{a,b,c}}
 ce={{a},{b},{c}}
 a:A(a), b:B(b) , c:C(c)



Relação M:N:P

create table A (a char primary key);
 create table B (b char primary key);
 create table C (c char primary key);

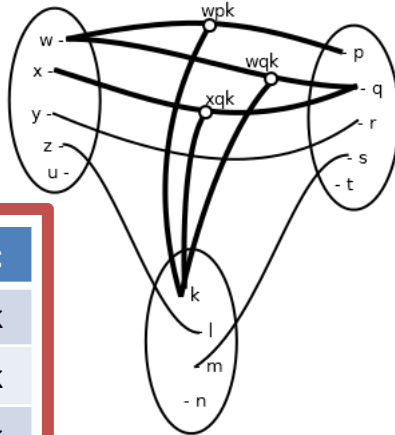
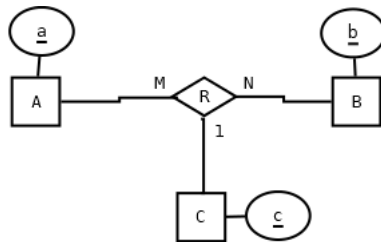
create table A_B_C (
 a char,
 b char,
 c char,
 foreign key(a) references A(a),
 foreign key(b) references B(b),
 foreign key(c) references C(c),
primary key(a,b,c)
);

A	<u>a</u>	B	<u>b</u>	C	<u>c</u>	A_B_C	<u>a</u>	<u>b</u>	<u>c</u>
	w		p		k		w	p	k
	x		q		l		w	p	l
	y		r		m		w	q	k
	z		s		n		x	q	k
	u		t				y	r	§
							z	§	l
							§	s	m

§ A chave não pode conter o valor NULL

A(a) cc={{a}}
 B(b) cc={{b}}
 C(c) cc={{c}}

A_B_C(a,b,c)
 cc={{**a,b**}}
 ce={{a},{b},{c}}
 a:A(a), b:B(b) , c:C(c)



Relação M:N:1

create table A (a char primary key);
 create table B (b char primary key);
 create table C (c char primary key);

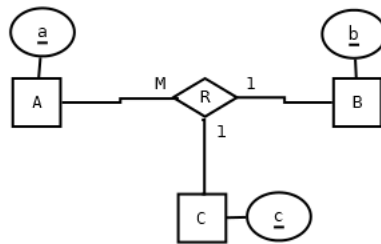
create table A_B_C (
 a char,
 b char,
 c char **null**,
 foreign key(a) references A(a),
 foreign key(b) references B(b),
 foreign key(c) references C(c),
primary key(a,b)
);

A	<u>a</u>	B	<u>b</u>	C	<u>b</u>	A_B_C	<u>a</u>	<u>b</u>	c
	w		p		k		w	p	k
	x		q		l		w	q	k
	y		r		m		x	q	k
	z		s		n		y	r	
	u		t				z	§	l
							§	s	m

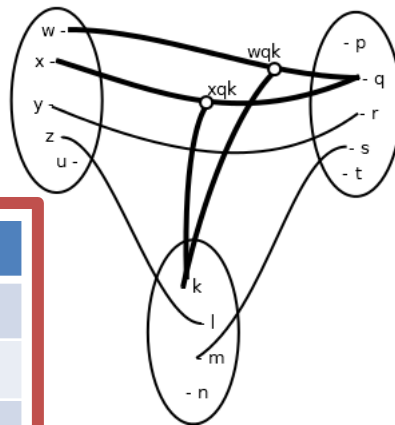
§ A chave não pode conter o valor NULL

A(a) cc={{a}}
 B(b) cc={{b}}
 C(c) cc={{c}}

A_B_C(a,b,c)
 cc={{a}}
 ce={{a},{b},{c}}
 a:A(a), b:B(b) , c:C(c)



Relação M:1:1



create table A (a char primary key);
 create table B (b char primary key);
 create table C (c char primary key);

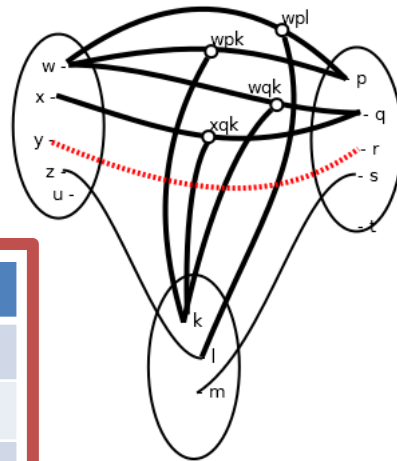
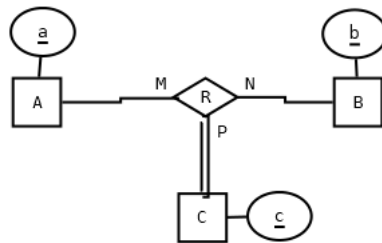
create table A_B_C (
 a char,
 b char **null**,
 c char **null**,
 foreign key(a) references A(a),
 foreign key(b) references B(b),
 foreign key(c) references C(c),
primary key(a)
);

A	<u>a</u>	B	<u>b</u>	C	<u>b</u>	A_B_C	<u>a</u>	b	c
	w		p		k		w	q	k
	x		q		l		x	q	k
	y		r		m		y	r	
	z		s		n		z		l
	u		t				§	s	m

§ A chave não pode conter o valor NULL

A(a) cc={{a}}
 B(b) cc={{b}}
 C(c) cc={{c}}

A_B_C(a,b,c)
 cc={{a,b,c}}
 ce={{a},{b},{c}}
 a:A(a), b:B(b) , c:C(c)



Relação M:N:P

```
create table A (a char primary key);
create table B (b char primary key);
create table C (c char primary key);
```

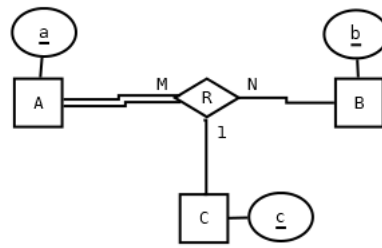
```
create table A_B_C (
  a char,
  b char,
  c char,
  foreign key(a) references A(a),
  foreign key(b) references B(b),
  foreign key(c) references C(c),
  primary key(a,b,c)
);
```

A	<u>a</u>	B	<u>b</u>	C	<u>c</u>	A_B_C	<u>a</u>	<u>b</u>	<u>c</u>
	w		p		k		w	p	k
	x		q		l		w	p	l
	y		r		m		w	q	k
	z		s		n		x	q	k
	u		t				y	r	§
							z	§	l
							§	s	m

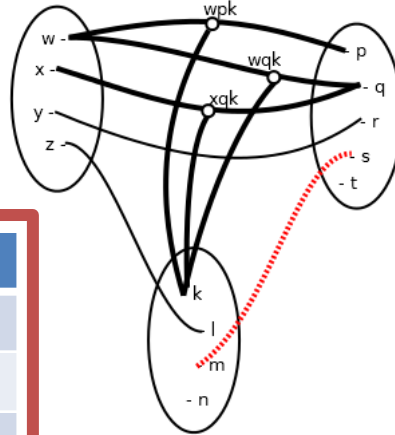
Não é possível

§ A chave não pode conter o valor NULL

A(a) cc={{a}}
 B(b) cc={{b}}
 C(c) cc={{c}}
 A_B_C(a,b,c)
 cc={{a,b}}
 ce={{a},{b},{c}}
 a:A(a), b:B(b) , c:C(c)



Relação M:N:1



create table A (a char primary key);
 create table B (b char primary key);
 create table C (c char primary key);

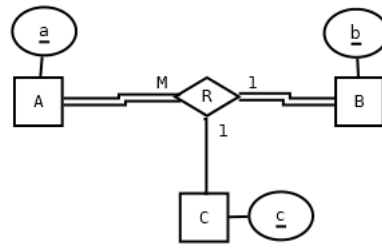
create table A_B_C (
 a char **not null**,
 b char **null**,
 c char **null**,
 foreign key(a) references A(a),
 foreign key(b) references B(b),
 foreign key(c) references C(c),
 primary key(a,b)
);

A	<u>a</u>	B	<u>b</u>	C	<u>b</u>	A_B_C	<u>a</u>	<u>b</u>	c
	w	p	k				w	p	k
	x	q	l				w	q	k
	y	r	m				x	q	k
	z	s	n				y	r	
		t					z		l
							§	s	m

Não é possível

§ Indicar coluna NOT NULL

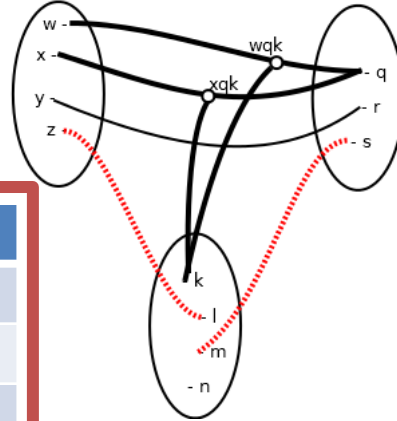
A(a) cc={{a}}
 B(b) cc={{b}}
 C(c) cc={{c}}
 A_B_C(a,b,c)
 cc={{a}}
 ce={{a},{b},{c}}
 a:A(a), b:B(b) , c:C(c)



Relação M:1:1

create table A (a char primary key);
 create table B (b char primary key);
 create table C (c char primary key);

create table A_B_C (
 a char not **null**,
 b char not **null**,
 c char **null**,
 foreign key(a) references A(a),
 foreign key(b) references B(b),
 foreign key(c) references C(c),
primary key(a)
);

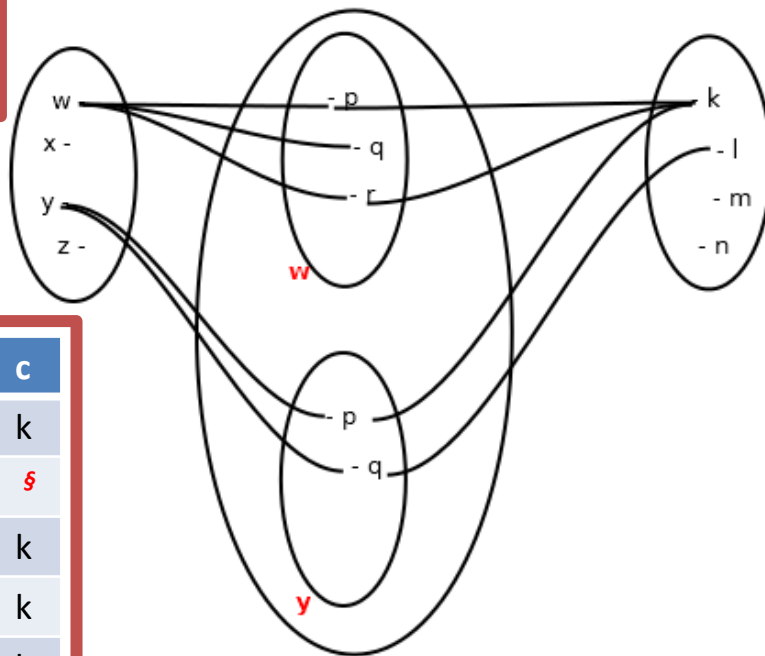
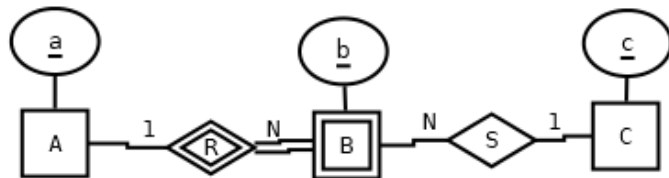


A	<u>a</u>	B	<u>b</u>	C	<u>b</u>	A_B_C	<u>a</u>	b	c
	w		p		k		w	q	k
	x		q		l		x	q	k
	y		r		m		y	r	§
	z		s		n		z		l
	u		t					s	m

Não é possível

§ Indicar coluna NULL

A(a) cc={{a}}
 B(b) cc={{b}}
 C(c) cc={{c}}
 B(a,b,c) cc={{a,b}}
 ce={{a},{c}}
 a:A(a), c:C(c)



A	<u>a</u>	C	<u>b</u>	B	<u>a</u>	<u>b</u>	c
	w		k		w	p	k
	x		l		w	q	s
	y		m		w	r	k
	z		n		y	p	k
	u				y	q	l

Entidade Fraca (B) e Relação indicativa (R)

create table A (
a char primary key);

create table C (
c char primary key);

create table B (
a char not **null**,
b char not **null**,
c char **null**,
foreign key(a) references A(a),
foreign key(c) references C(c),
primary key(a,b)
);

s Indicar coluna NULL

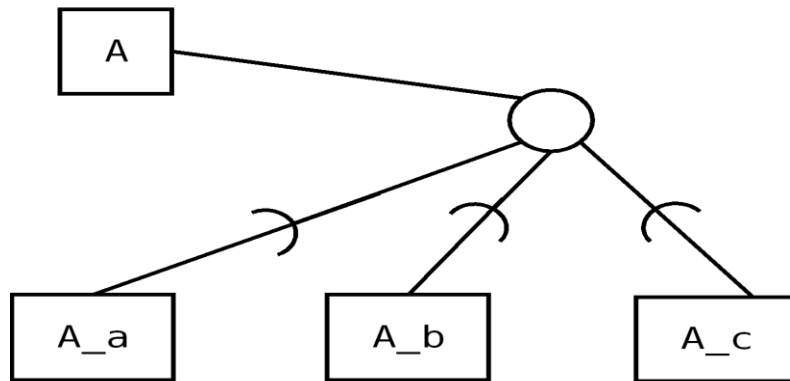
Generalização / Especialização

Superclasse - A

Subclasses – A_a, A_b, A_c

A é o caso geral de A_a, A_b, A_c

A é a generalização de A_a, A_b, A_c



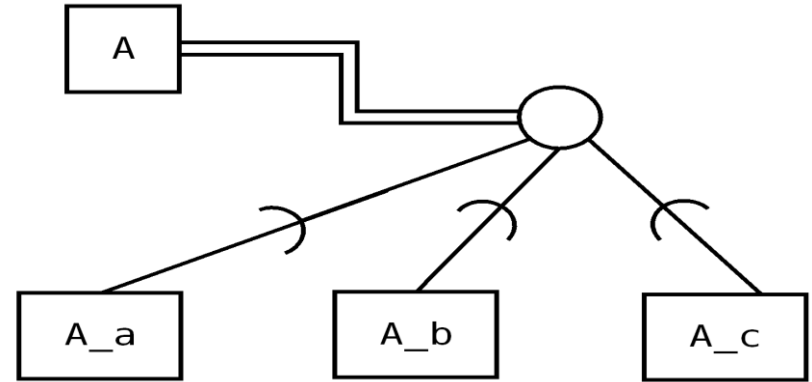
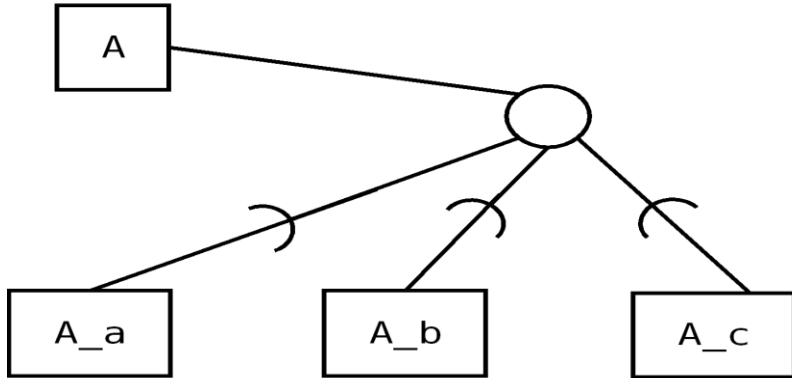
(semântica: is-a ou é-um)

A_a, A_b, A_c são especializações de A

A_a, A_b e A_c têm os seus próprios atributos e também todos os atributos de A

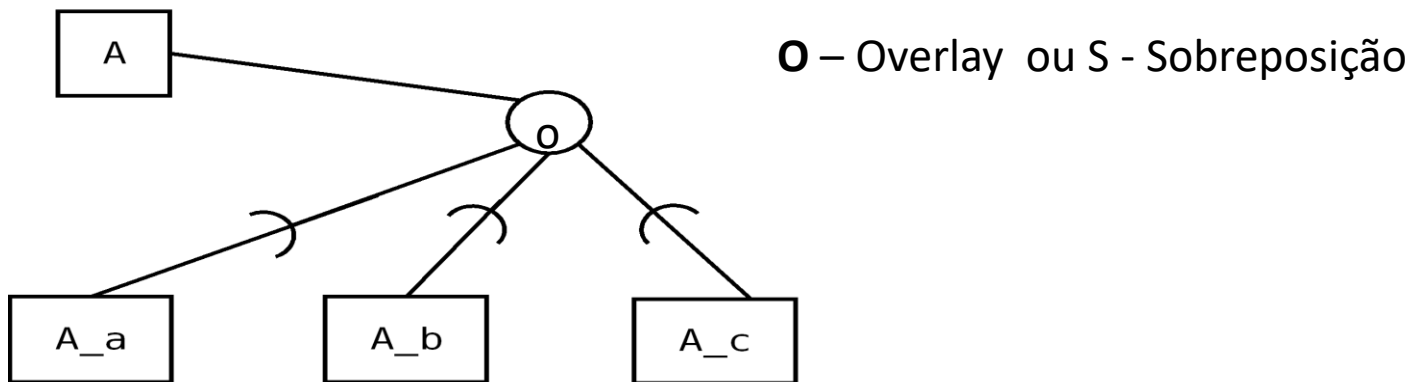
Generalização – parcial ou total

Parcial - uma entidade de uma superclasse pode não pertencer a qualquer uma das subclasses



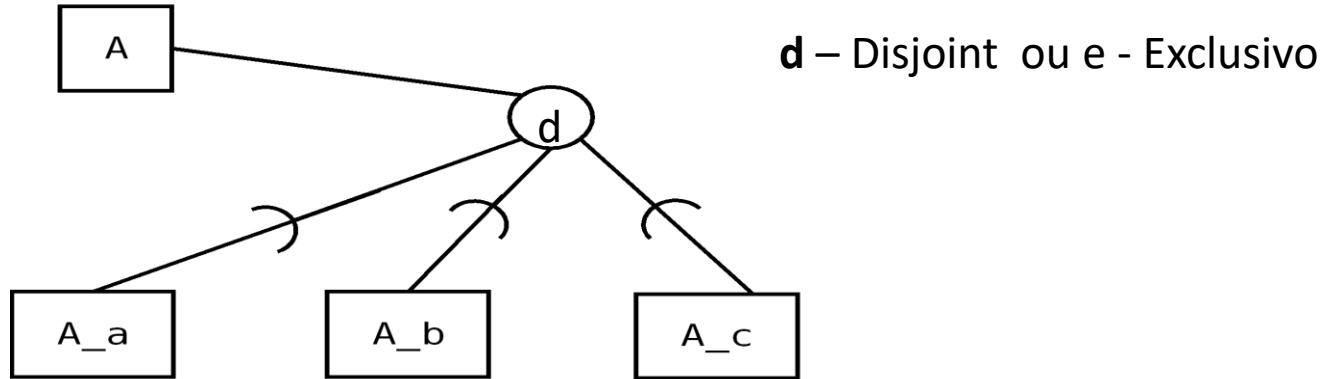
Total - cada entidade de uma superclasse deve ser membro de alguma subclasse na especialização

Generalização - Sobreposição



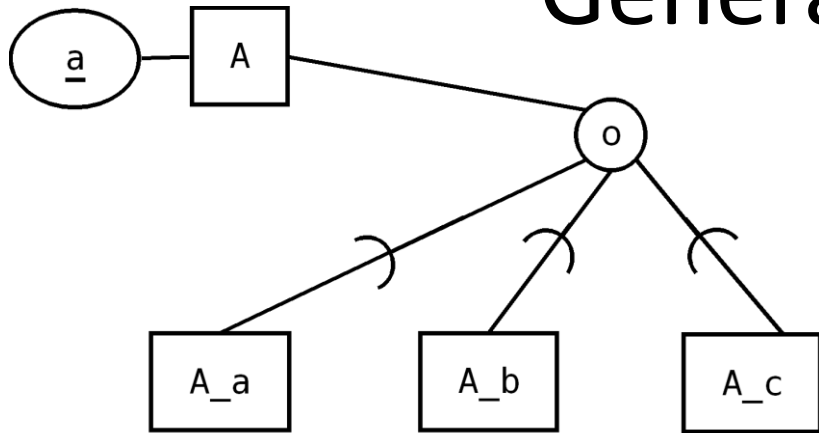
Um elemento de A pode ser uma combinação
de entre todas as combinações possíveis entre A_a, A_b e A_c

Generalização - Exclusivo



Um elemento de A pode ser um de entre A_a, A_b ou A_c

Generalização



```
create table A (  
  a char,  
  A_a varchar(10) null,  
  A_b varchar(10) null,  
  A_c varchar(10) null,  
  primary key(a)  
);
```

```
A(a, A_a, A_b, A_c)  
cc={{a}}
```

$A(a) \text{ cc}=\{\{a\}\}$

$A_a(a) \text{ cc}=\{\{a\}\} \text{ ce}=\{\{a\}\}$

$A_b(a) \text{ cc}=\{\{a\}\} \text{ ce}=\{\{a\}\}$

$A_c(a) \text{ cc}=\{\{a\}\} \text{ ce}=\{\{a\}\}$

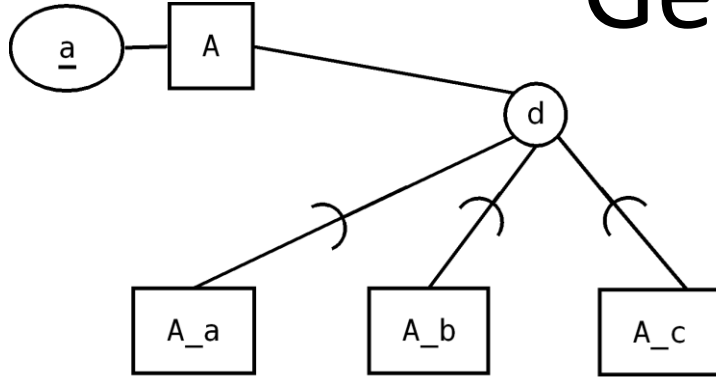
```
create table A (a char primary key);
```

```
create table A_a(a char,  
  foreign key(a) references A(a),  
  primary key(a) );
```

```
create table A_b(a char,  
  foreign key(a) references A(a),  
  primary key(a) );
```

```
create table A_c(a char,  
  foreign key(a) references A(a),  
  primary key(a) );
```

Generalização



```
create table A (  
  a char primary key,  
  tipo ENUM('A_a', 'A_b', 'A_c') null  
); -- participação parcial
```

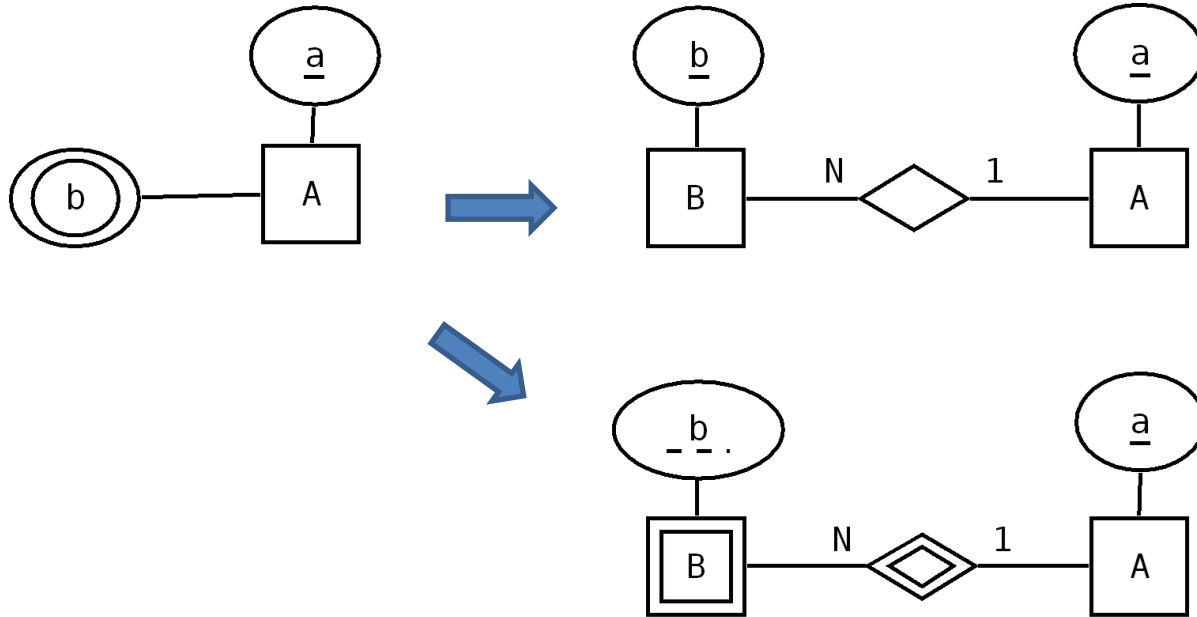
```
create table A (  
  a char primary key,  
  tipo varchar(10),  
  foreign key (tipo) references Tipo(tipo)  
);
```

```
create table Tipo(tipo varchar(10) primary key);  
insert into Tipo values ('A_a'), ('A_b'), ('A_c');
```

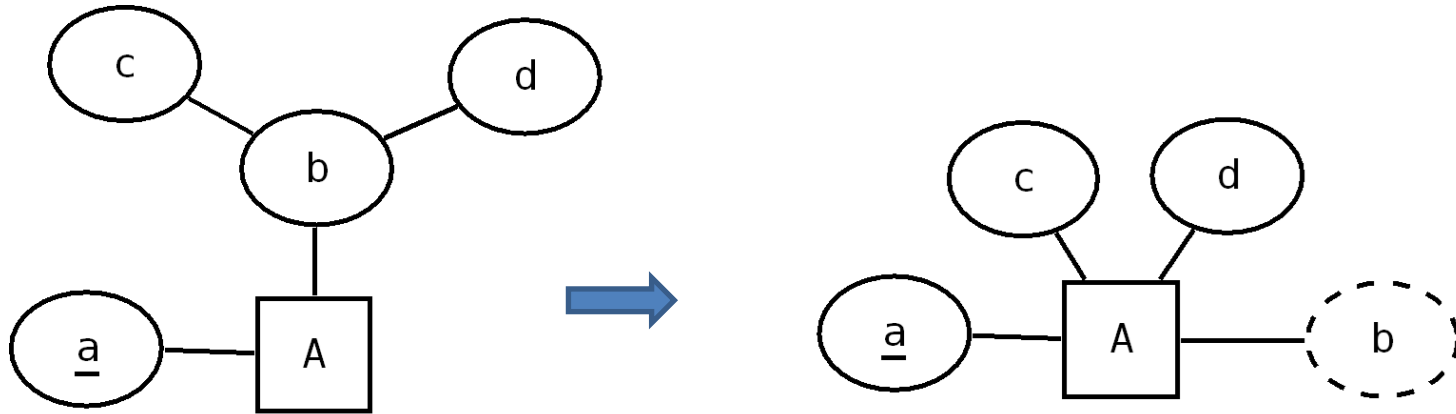
```
create table A (  
  a char primary key,  
  tipo ENUM('A_a', 'A_b', 'A_c')  
); -- participação total
```

§ Solução idêntica à de “sobreposição”

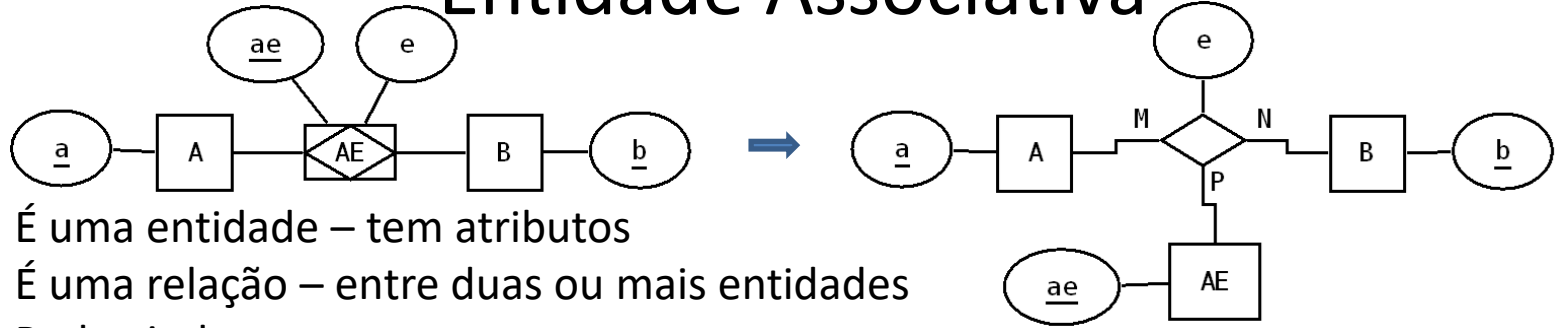
Multivariavel



Atributo Composto



Entidade Associativa

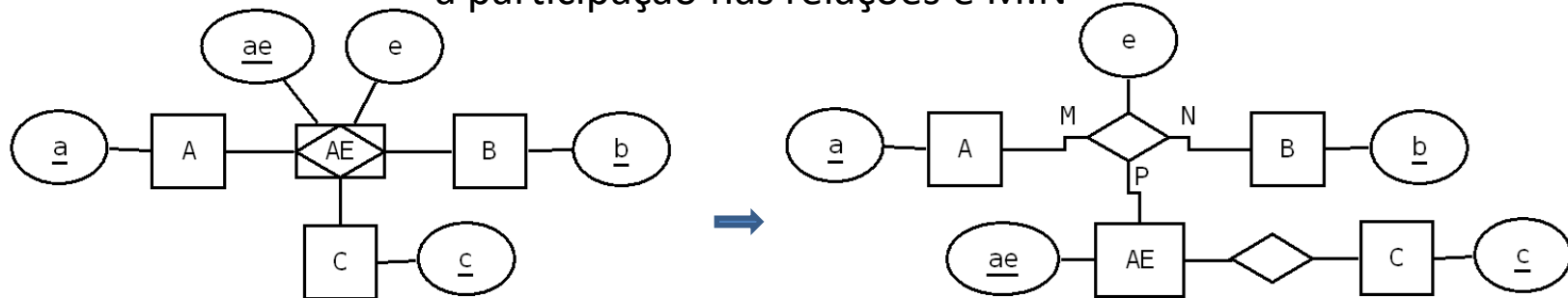


É uma entidade – tem atributos

É uma relação – entre duas ou mais entidades

Pode ainda:

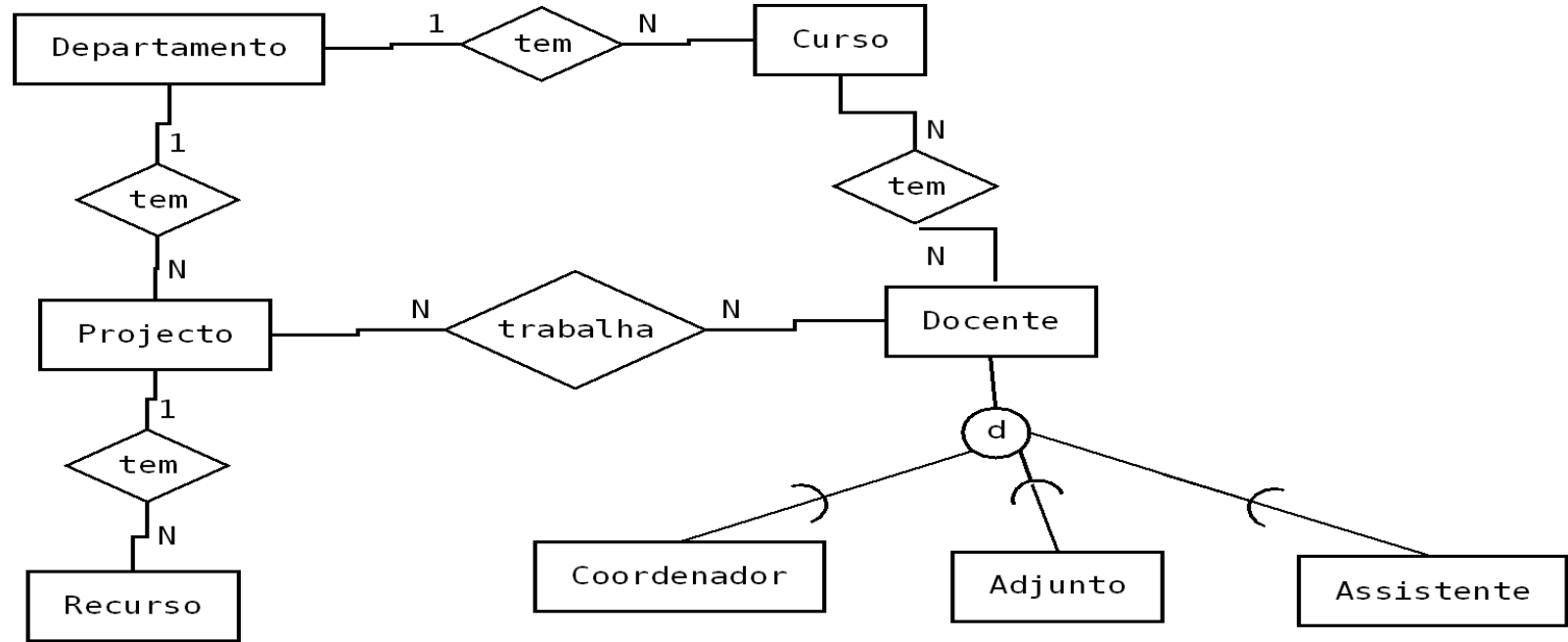
- ter um significado independente das outras entidades
- ter de preferência um identificador único, e outros atributos
- ser usado como entidade e ou relação
- ser a melhor forma de representar uma relação ternária
- a participação nas relações é M:N



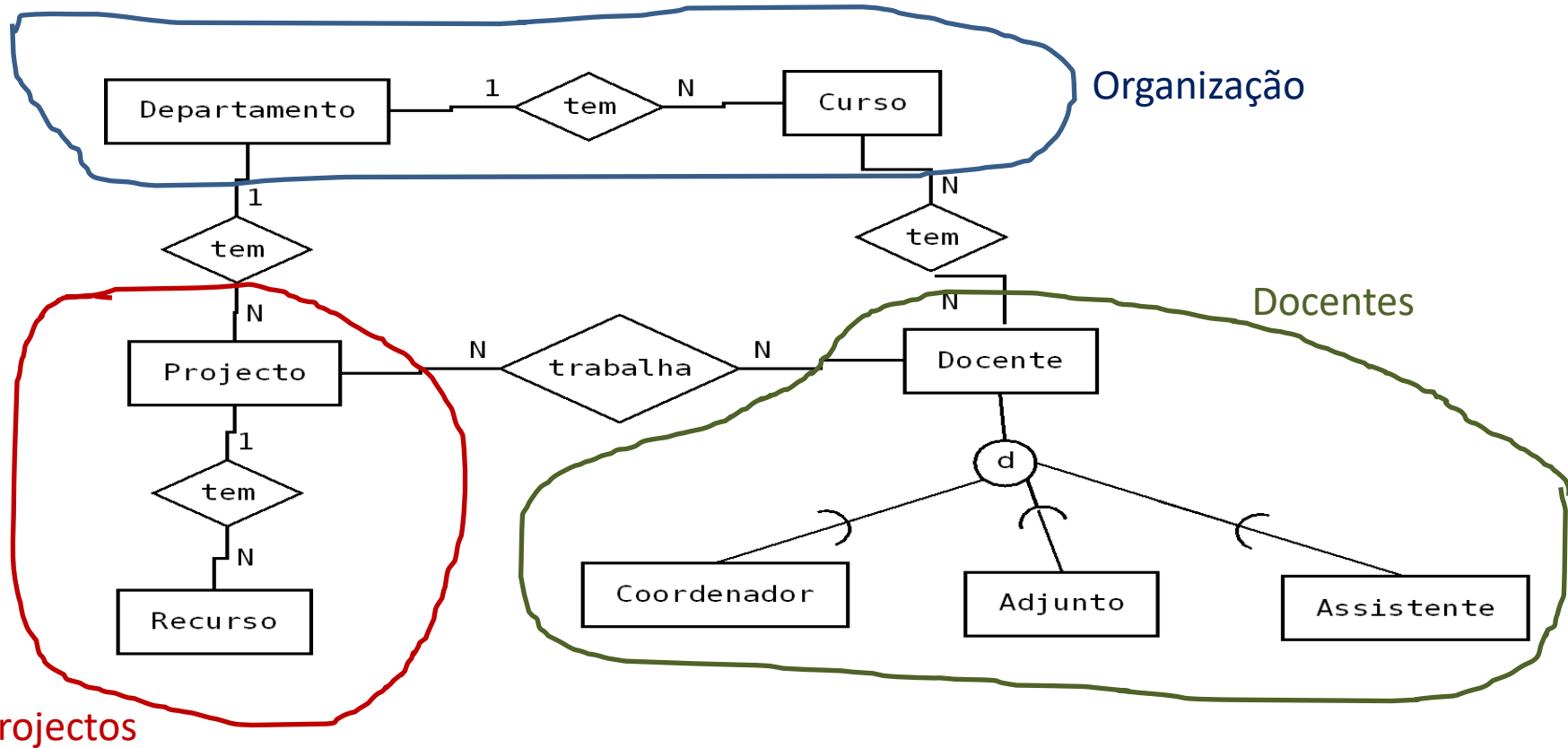
Método

- 1 – Entidades
- 2 – Entidades Fracas
- 3 – Relacionamentos 1:1
- 4 – Relacionamentos 1:N
- 5 – Relacionamentos M:N
- 6 – Atributos multivalor
- 7 – Relacionamentos de grau superior a 2
- 8 – Especializações e Generalizações
- 9 – Categorias

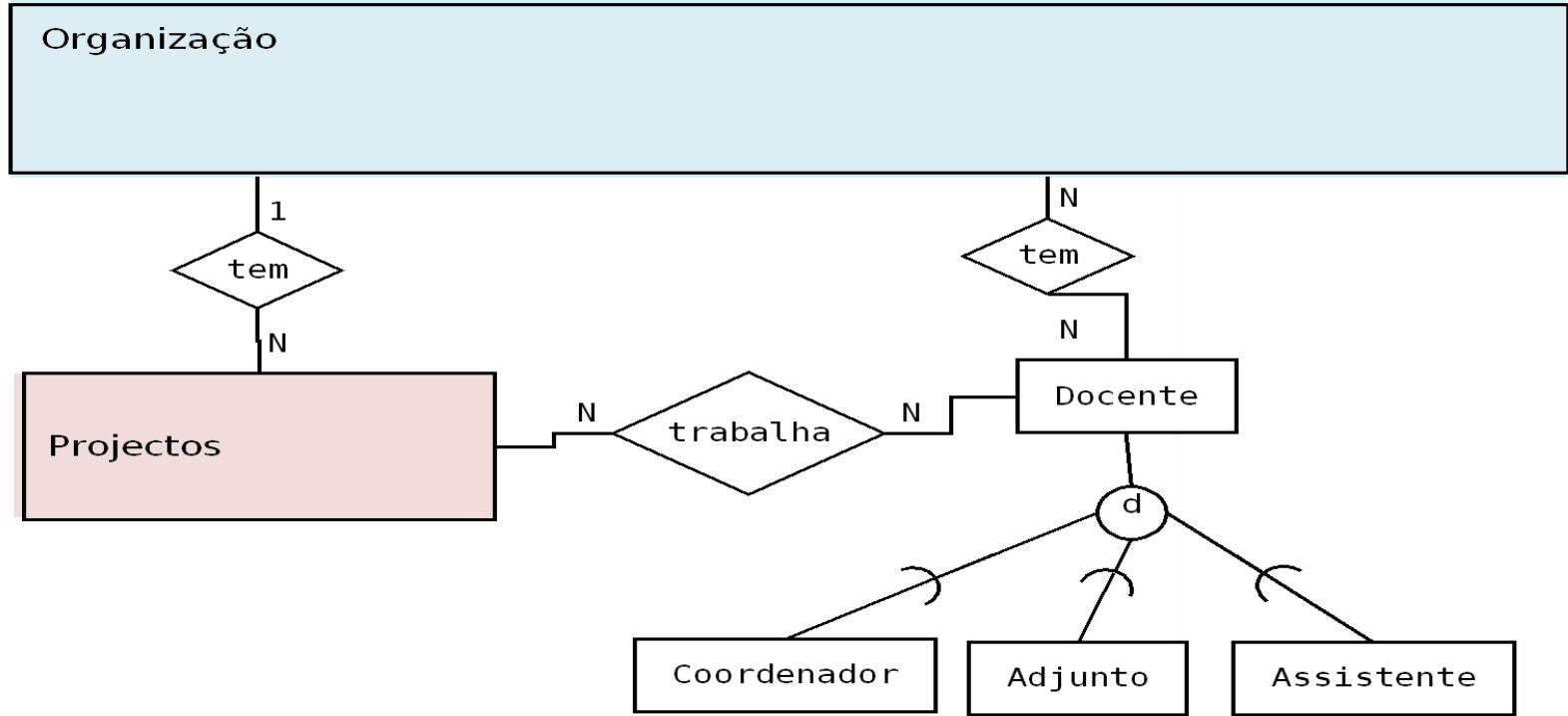
Área Funcional



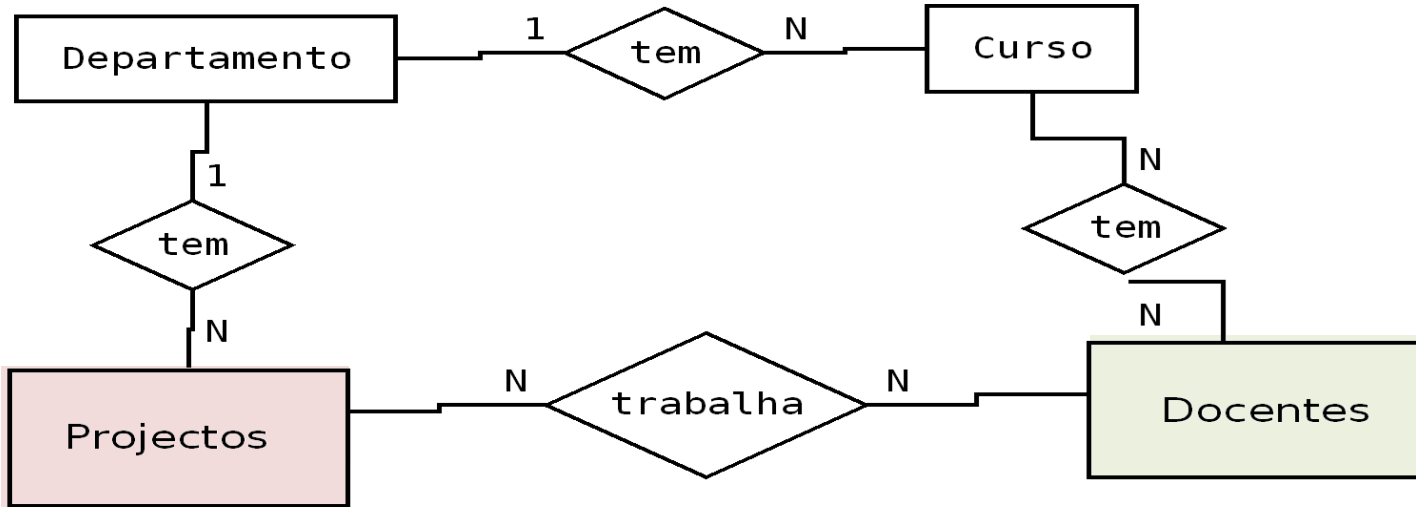
Área Funcional



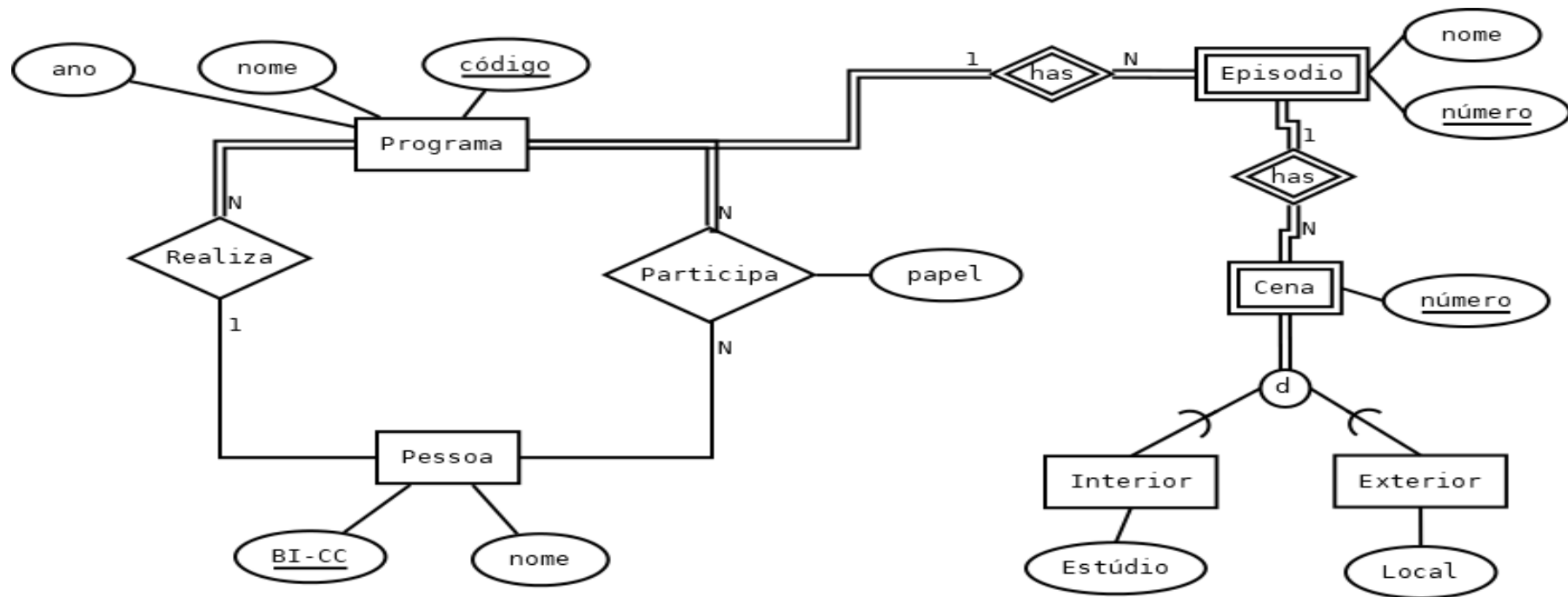
Cluster



Cluster



Exemplo



Referência

Notações: www.ischool.drexel.edu/faculty/song/publications/p_jcse-erd.pdf

Ferramentas:

<http://raymondcho.net/RelationalDatabaseTools/RelationalDatabaseTools.html>