

Álgebra Relacional

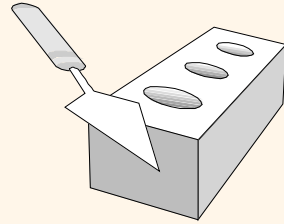
❖ Proposta por E. F. Codd:

A Relational Model of Data for Large
Shared Data Banks, 1970

ACM Classic of the Month

<http://www.acm.org/classics/nov95/>

Operacional x Declarativo



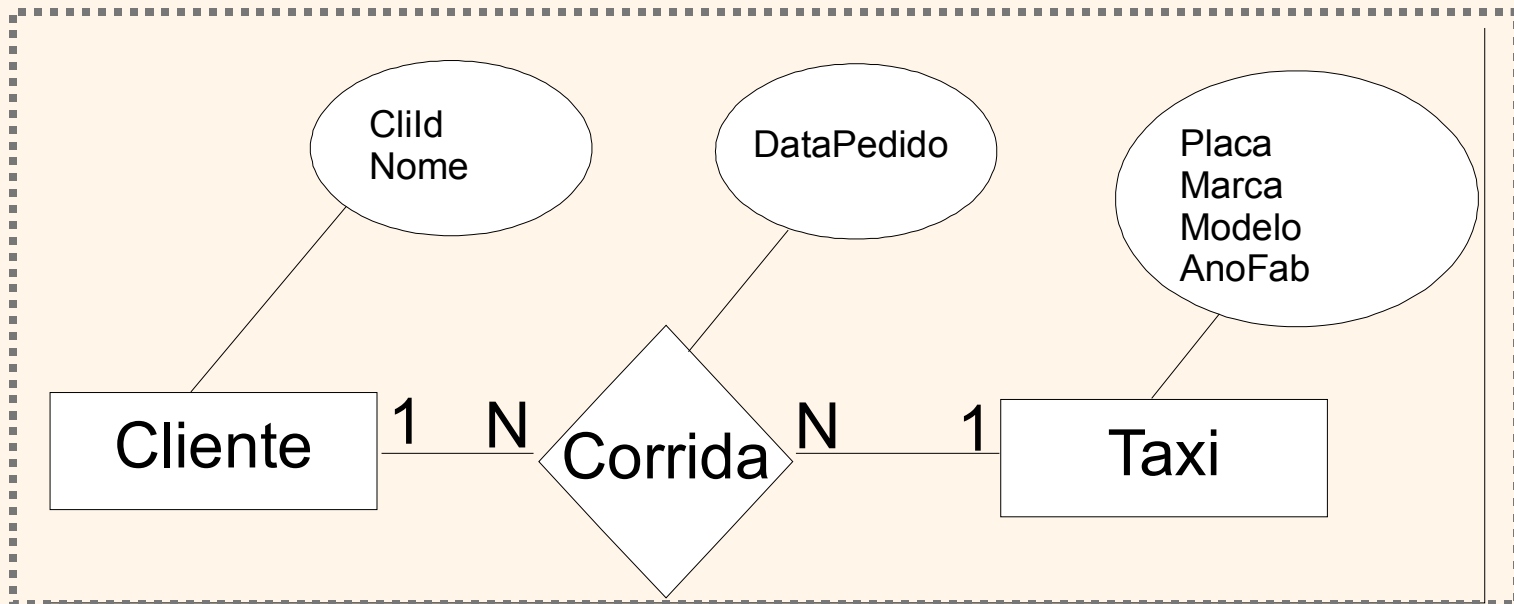
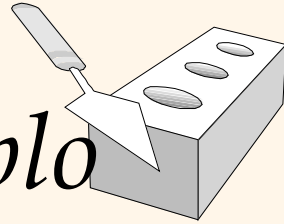
❖ Declarativo:

- Quero um misto quente

❖ Operacional:

- Quero duas fatias de pão de forma, recheadas com uma fatia de queijo e uma fatia de presunto. Tudo isto bem tostado.

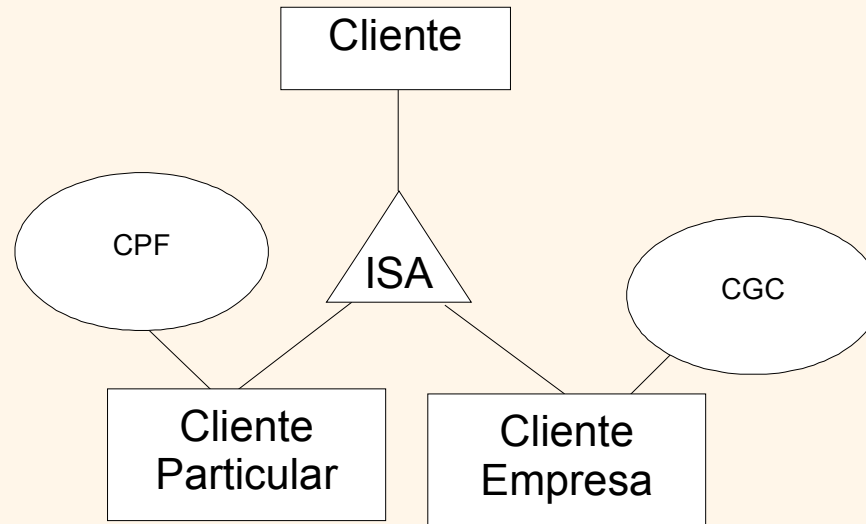
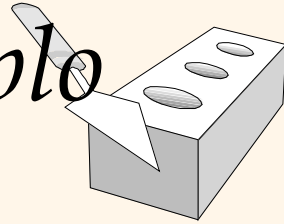
Esquema Conceitual para exemplo Táxis



Este é um subconjunto do Estudo de Caso proposto “Despacho e controle de Táxis via terminais móveis ligados on-line com um sistema multi-usuário”.

Esquema Conceitual para exemplo

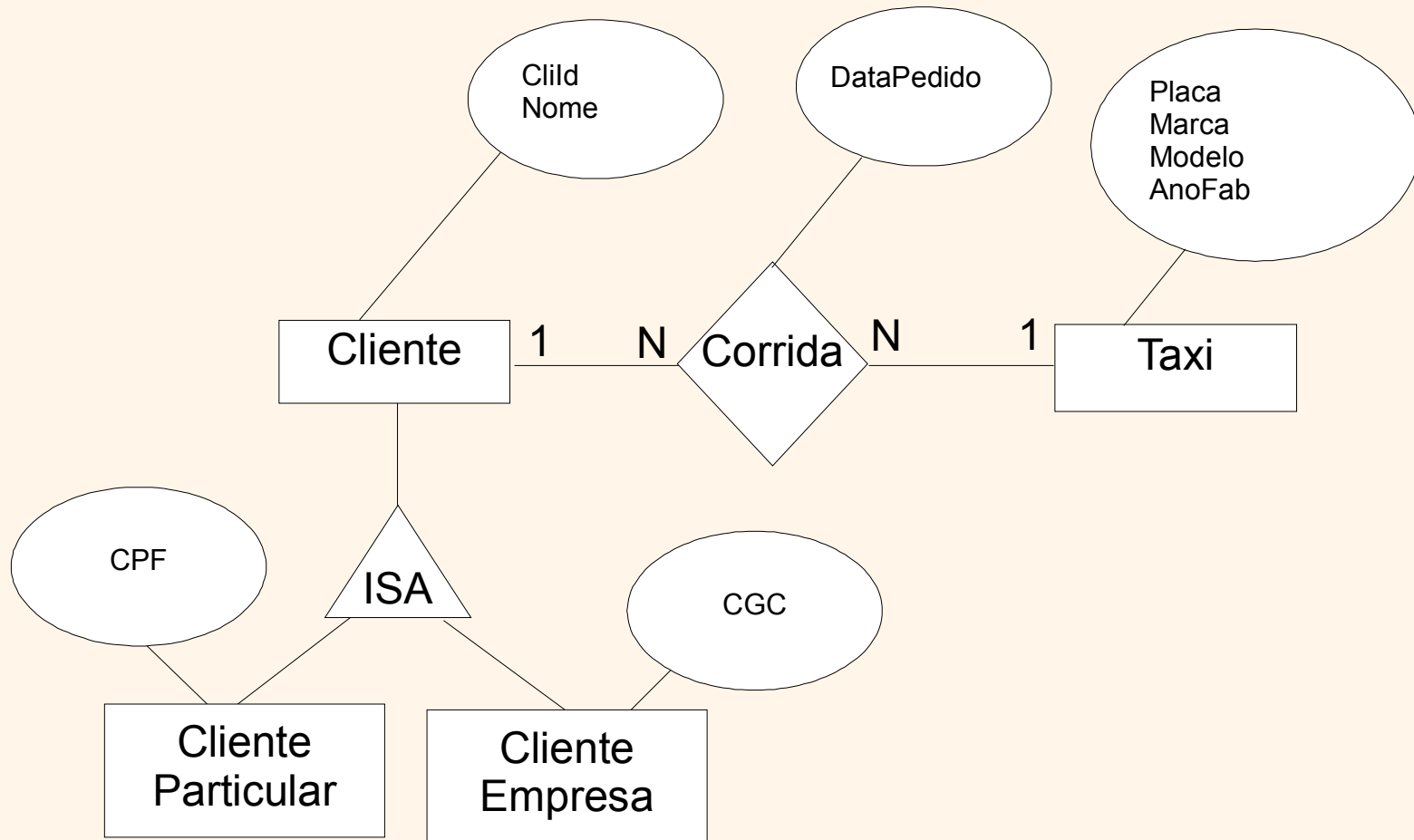
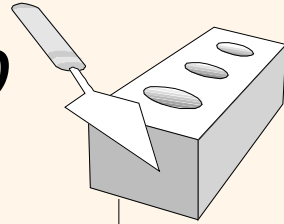
Cliente



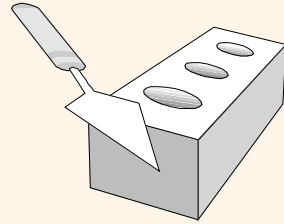
Para ilustrar o tema apresentado, foram acrescentadas duas entidades que são especialização de Cliente. A primeira representa um indivíduo que irá pagar a conta, a segunda representa um funcionário de uma empresa conveniada, para a qual a conta será enviada. Um cliente pode pertencer a ambas especializações.

Esquema Conceitual completo

Táxis



Tabelas para exemplo - Táxis



Cliente Particular (CP)

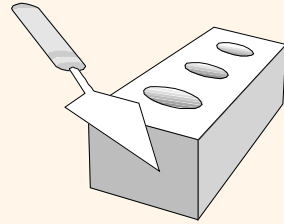
<u>CliId</u>	Nome	CPF
1532	Asdrúbal	448.754.253-65
1755	Doriana	567.387.387-44
1780	Quincas	546.373.762-02



Cliente Empresa (CE)

<u>CliId</u>	Nome	CGC
1532	Asdrúbal	754.856.965/0001-54
1644	Jepeto	478.652.635/0001-75
1780	Quincas	554.663.996/0001-87
1982	Zandor	736.952.369/0001-23

Tabelas para exemplo - Táxis



Táxi (TX)

<u>Placa</u>	Marca	Modelo	AnoFab
DAE6534	Ford	Fiesta	1999
DKL4598	Wolkswagen	Gol	2001
DKL7878	Ford	Fiesta	2001
JDM8776	Wolkswagen	Santana	2002
JJM3692	Chevrolet	Corsa	1999

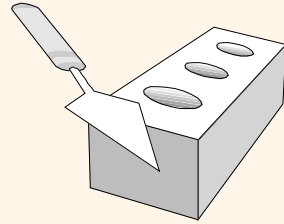


Corrida (R1)

<u>ClId</u>	<u>Placa</u>	<u>DataPedido</u>
1755	DAE6534	15/02/2003
1982	JDM8776	18/02/2003



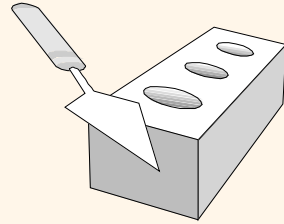
Projeção



$\pi_{\text{Marca, Modelo}}(\text{TX})$

<u>Placa</u>	Marca	Modelo	AnoFab
DAE6534	Ford	Fiesta	1999
DKL4598	Wolksvagen	Gol	2001
DKL7878	Ford	Fiesta	2001
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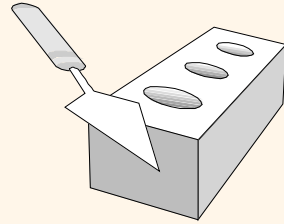
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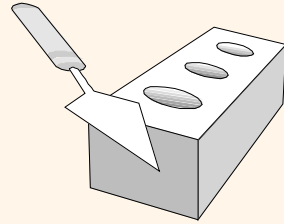
Projeção



$\pi_{\text{Marca, Modelo}}(\text{TX})$

Marca	Modelo
Ford	Fiesta
Wolksvagen	Gol
Ford	Fiesta
Wolksvagen	Santana
Chevrolet	Corsa

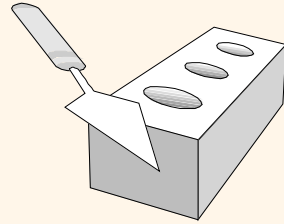
Projeção



$\pi_{\text{Marca, Modelo}}(\text{TX})$

Marca	Modelo
Ford	Fiesta
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Ford	Fiesta
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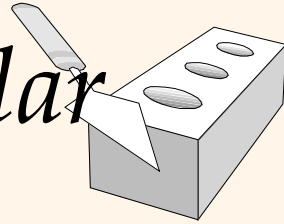
Projeção



$\pi_{\text{Marca, Modelo}}(\text{TX})$

Marca	Modelo
Ford	Fiesta
Wolksvagen	Gol
Wolksvagen	Santana
Chevrolet	Corsa

Projeção Tabela Cliente Particular



$\pi_{\text{CliId, Nome}}(\text{CP})$

<u>CliId</u>	Nome	CPF
1532	Asdrúbal	448.754.253-65
1755	Doriana	567.387.387-44
1780	Quincas	546.373.762-02

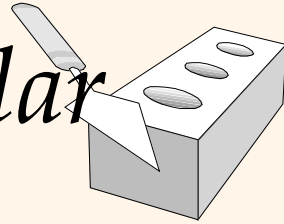


C1*

<u>CliId</u>	Nome
1532	Asdrúbal
1755	Doriana
1780	Quincas

(*) Adotaremos o nome C1 para o resultado da projeção (o modo como isto é feito será estudado mais adiante em renomeação).

Projeção Tabela Cliente Particular



$\pi_{\text{CliId, Nome}}(\text{CE})$

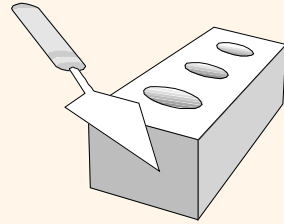
<u>CliId</u>	Nome	CGC
1532	Asdrúbal	754.856.965/0001-54
1644	Jepeto	478.652.635/0001-75
1780	Quincas	554.663.996/0001-87
1982	Zandor	736.952.369/0001-23



C2

<u>CliId</u>	Nome
1532	Asdrúbal
1644	Jepeto
1780	Quincas
1982	Zandor

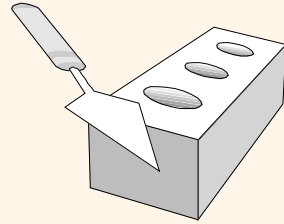
Seleção



$\sigma_{\text{AnoFab} > 2000}(\text{TX})$

<u>Placa</u>	Marca	Modelo	AnoFab
DAE6534	Ford	Fiesta	1999
DKL4598	Wolksvagen	Gol	2001
DKL7878	Ford	Fiesta	2001
JDM8776	Wolksvagen	Santana	2002
JJM3692	Chevrolet	Corsa	1999

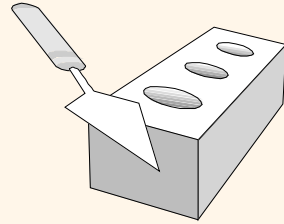
Seleção



$\sigma_{\text{AnoFab} > 2000}(\text{TX})$

<u>Placa</u>	Marca	Modelo	AnoFab
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DKL4598	Wolksvagen	Gol	2001
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JDM8776	Wolksvagen	Santana	2002
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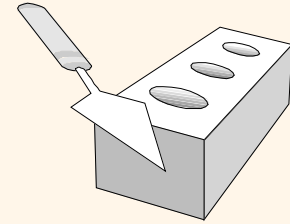
Seleção



$\sigma_{\text{AnoFab} > 2000}(\text{TX})$

<u>Placa</u>	Marca	Modelo	AnoFab
DKL4598	Wolkswagen	Gol	2001
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União

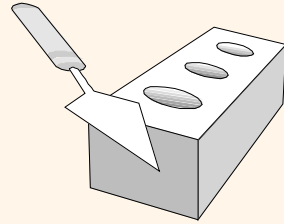


$$C1 \cup C2$$

<u>ClId</u>	Nome
1532	Asdrúbal
1755	Doriana
1780	Quincas

<u>ClId</u>	Nome
1532	Asdrúbal
1644	Jepeto
1780	Quincas
1982	Zandor

União



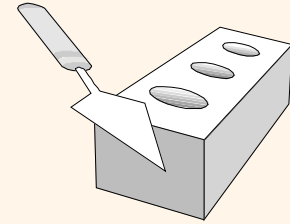
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<u>ClId</u>	Nome
1532	Asdrúbal
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1780	Quincas
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União



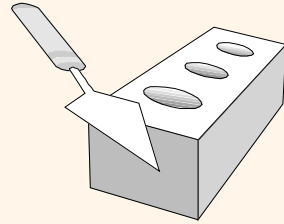
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<u>cliId</u>	Nome
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1982	Zandor

<u>cliId</u>	Nome
1532	Asdrúbal
1644	Jepeto
1755	Doriana
1780	Quincas
1982	Zandor

Interseção

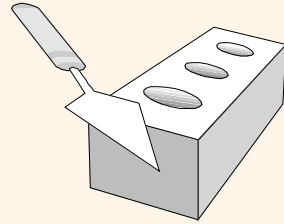


$$C1 \cap C2$$

<u>ClId</u>	Nome
1532	Asdrúbal
1755	Doriana
1780	Quincas

<u>ClId</u>	Nome
1532	Asdrúbal
1644	Jepeto
1780	Quincas
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Interseção



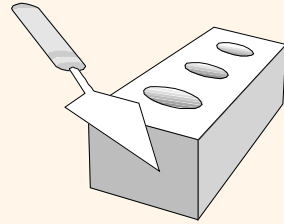
$$C1 \cap C2$$

<u>cliId</u>	Nome
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<u>cliId</u>	Nome
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Interseção



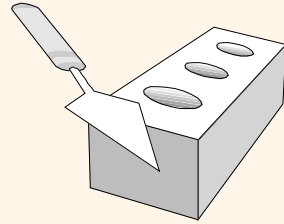
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<u>cliId</u>	Nome
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1532	Asdrúbal
1644	Jepeto
1780	Quincas
1982	Zandor

<u>cliId</u>	Nome
1532	Asdrúbal
1780	Quincas

Diferença de conjuntos

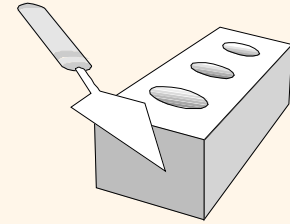


C1 - C2

<u>cliId</u>	Nome
1532	Asdrúbal
1755	Doriana
1780	Quincas

<u>cliId</u>	Nome
1532	Asdrúbal
1644	Jepeto
1780	Quincas
1982	Zandor

Diferença de conjuntos



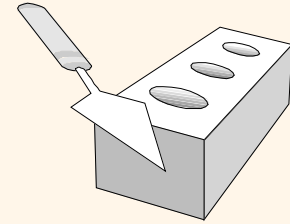
C1 - C2

<u>cliId</u>	Nome
1532	Asdrúbal
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1780	Quincas

<u>cliId</u>	Nome
1532	Asdrúbal
1644	Jepeto
1780	Quincas
1982	Zandor

<u>cliId</u>	Nome
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Diferença de conjuntos



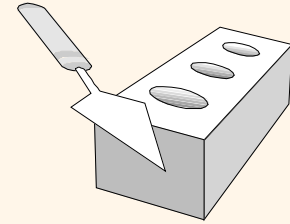
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<u>cliId</u>	Nome
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<u>cliId</u>	Nome
1532	Asdrúbal
1644	Jepeto
1780	Quincas
1982	Zandor

<u>cliId</u>	Nome
1755	Doriana

Diferença de conjuntos



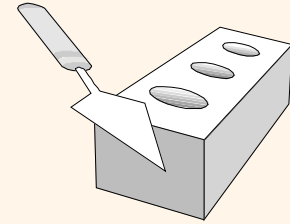
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1532	Asdrúbal
1644	Jepeto
1780	Quincas
1982	Zandor

<u>cliId</u>	Nome
1755	Doriana

Diferença de conjuntos



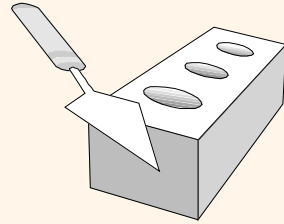
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<u>CliId</u>	Nome
1532	Asdrúbal
1755	Doriana
1780	Quincas

<u>CliId</u>	Nome
1532	Asdrúbal
1644	Jepeto
1780	Quincas
1982	Zandor

<u>CliId</u>	Nome
1755	Doriana

Produto Cartesiano

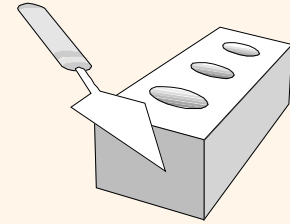


$C1 \times R1$

<u>CliId</u>	Nome
1532	Asdrúbal
1755	Doriana
1780	Quincas

<u>CliId</u>	<u>Placa</u>	<u>DataPedido</u>
1755	DAE6534	15/02/2003
1982	JDM8776	18/02/2003

Produto Cartesiano



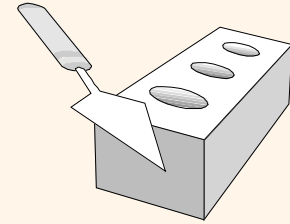
$$C1 \times R1$$

<u>CliId</u>	Nome
1532	Asdrúbal
1755	Doriana
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<u>CliId</u>	<u>Placa</u>	<u>DataPedido</u>
1755	DAE6534	15/02/2003
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(<u>CliId</u>)	Nome	(<u>CliId</u>)	Placa	DataPedido
1532	Asdrúbal	1755	DAE6534	15/02/2003
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Produto Cartesiano



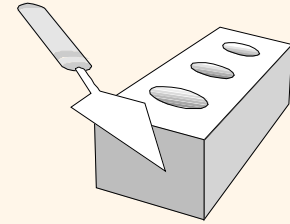
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1532	Asdrúbal
1755	Doriana
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<u>CliId</u>	<u>Placa</u>	<u>DataPedido</u>
1755	DAE6534	15/02/2003
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<u>(CliId)</u>	<u>Nome</u>	<u>(CliId)</u>	<u>Placa</u>	<u>DataPedido</u>
1532	Asdrúbal	1755	DAE6534	15/02/2003
1532	Asdrúbal	1982	JDM8776	18/02/2003
1755	Doriana	1755	DAE6534	15/02/2003
1755	Doriana	1982	JDM8776	18/02/2003

Produto Cartesiano



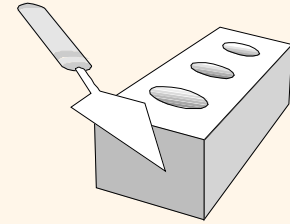
$$C1 \times R1$$

<u>ClId</u>	<u>Nome</u>
1532	Asdrúbal
1755	Doriana
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<u>ClId</u>	<u>Placa</u>	<u>DataPedido</u>
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(ClId)	Nome	(ClId)	Placa	DataPedido
1532	Asdrúbal	1755	DAE6534	15/02/2003
1532	Asdrúbal	1982	JDM8776	18/02/2003
1755	Doriana	1755	DAE6534	15/02/2003
1755	Doriana	1982	JDM8776	18/02/2003
1780	Quincas	1755	DAE6534	15/02/2003
1780	Quincas	1982	JDM8776	18/02/2003

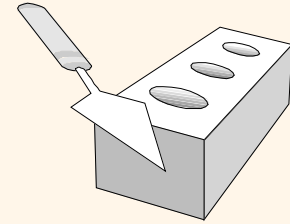
Junção



$C1 \bowtie_{C1.CliId < R1.CliId} R1$

(CliId)	Nome	(CliId)	Placa	DataPedido
1532	Asdrúbal	1755	DAE6534	15/02/2003
1532	Asdrúbal	1982	JDM8776	18/02/2003
1755	Doriana	1755	DAE6534	15/02/2003
1755	Doriana	1982	JDM8776	18/02/2003
1780	Quincas	1755	DAE6534	15/02/2003
1780	Quincas	1982	JDM8776	18/02/2003

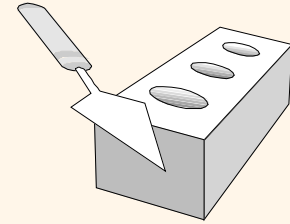
Junção



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(CliId)	Nome	(CliId)	Placa	DataPedido
1532	Asdrúbal	1755	DAE6534	15/02/2003
1532	Asdrúbal	1982	JDM8776	18/02/2003
1755	Doriana	1755	DAE6534	15/02/2003
1755	Doriana	1982	JDM8776	18/02/2003
1780	Quincas	1755	DAE6534	15/02/2003
1780	Quincas	1982	JDM8776	18/02/2003

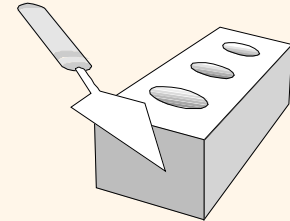
Junção



$C1 \bowtie_{C1.CliId < R1.CliId} R1$

(CliId)	Nome	(CliId)	Placa	DataPedido
1532	Asdrúbal	1755	DAE6534	15/02/2003
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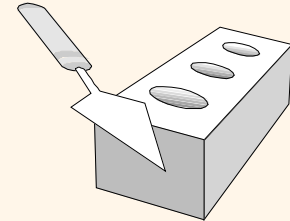
Equi-Junção



$C1 \bowtie_{\text{CliId}} R1$

(CliId)	Nome	(CliId)	Placa	DataPedido
1532	Asdrúbal	1755	DAE6534	15/02/2003
1532	Asdrúbal	1982	JDM8776	18/02/2003
1755	Doriana	1755	DAE6534	15/02/2003
1755	Doriana	1982	JDM8776	18/02/2003
1780	Quincas	1755	DAE6534	15/02/2003
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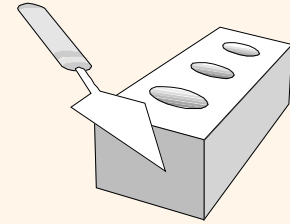
Equi-Junção

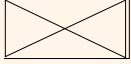


$C1 \bowtie_{\text{CliId}} R1$

(CliId)	Nome	(CId)	Placa	DataPedido
1532	Asdrúbal	1755	DAE6534	15/02/2003
1532	Asdrúbal	1982	JDM8776	18/02/2003
1755	Doriana	1755	DAE6534	15/02/2003
1755	Doriana	1982	JDM8776	18/02/2003
1780	Quincas	1755	DAE6534	15/02/2003
1780	Quincas	1982	JDM8776	18/02/2003

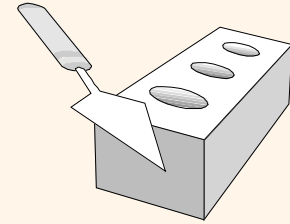
Equi-Junção

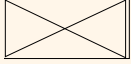


C1  CliId R1

(CliId)	Nome	(CliId)	Placa	DataPedido
1755	Doriana	1755	DAE6534	15/02/2003

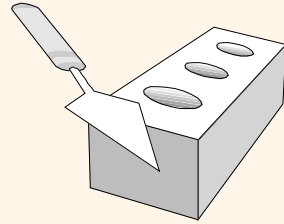
Equi-Junção



C1  R1
CliId

CliId	Nome	Placa	DataPedido
1755	Doriana	DAE6534	15/02/2003

Renomeação

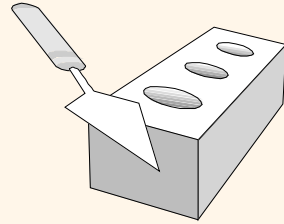


$\rho(\text{FR}, \sigma_{\text{Marca}=\text{'Ford'}} \text{TX})$

TX

<u>Placa</u>	Marca	Modelo	AnoFab
DAE6534	Ford	Fiesta	1999
DKL4598	Wolkswagen	Gol	2001
DKL7878	Ford	Fiesta	2001
JDM8776	Wolkswagen	Santana	2002
JJM3692	Chevrolet	Corsa	1999

Renomeação

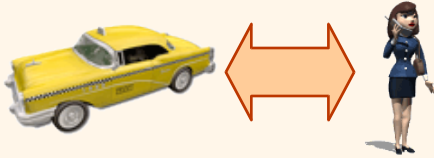


$\rho(\text{FR}, \sigma_{\text{Marca}='Ford'} \text{TX})$

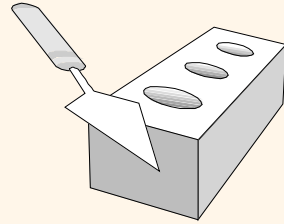
FR

<u>Placa</u>	Marca	Modelo	AnoFab
DAE6534	Ford	Fiesta	1999
DKL7878	Ford	Fiesta	2001

Tabela adicional



Corrida (R2)



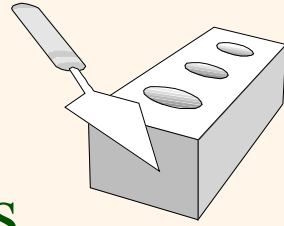
<u>ClId</u>	<u>Placa</u>	<u>DataPedido</u>
1532	DAE6534	15/02/2003
1532	DKL4586	17/02/2003
1644	DKL7878	10/01/2003
1644	JDM8776	18/02/2003
1780	JJM3692	08/01/2003
1982	DAE6534	15/01/2003
1982	DKL4598	26/01/2003
1982	DKL7878	01/02/2003



Táxi (FR)

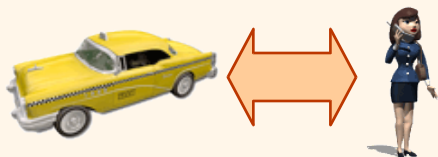
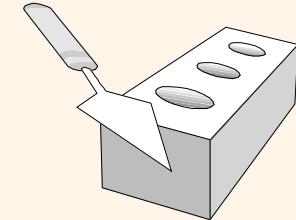
<u>Placa</u>	Marca	Modelo	AnoFab
DAE6534	Ford	Fiesta	1999
DKL7878	Ford	Fiesta	2001

Divisão



Encontre clientes que tenham andado com todos os táxis da Marca Ford.

Divisão



$\rho(\text{SR2}, \pi_{\text{CId, Placa}}(\text{R2}))$

CId	Placa
1532	DAE6534
1532	DKL4586
1644	DKL7878
1644	JDM8776
1780	JJM3692
1982	DAE6534
1982	DKL4598
1982	DKL7878

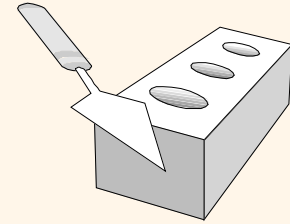


$\rho(\text{SFR}, \pi_{\text{Placa}}(\text{FR}))$

Placa
DAE6534
DKL7878

Divisão

SR2 / SFR

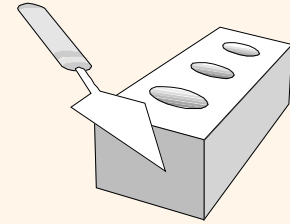


CIId	Placa
1532	DAE6534
1532	DKL4586
1644	DKL7878
1644	JDM8776
1780	JJM3692
1982	DAE6534
1982	DKL4598
1982	DKL7878

Placa
DAE6534
DKL7878

Divisão

SR2 / SFR



CIId	Placa
1532	DAE6534
1532	DKL4586
1644	DKL7878
1644	JDM8776
1780	JJM3692
1982	DAE6534
1982	DKL4598
1982	DKL7878

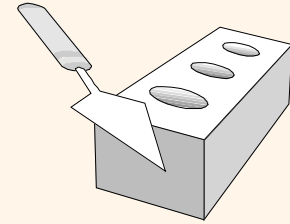
Placa
DAE6534
DKL7878

?

CIId

Divisão

SR2 / SFR



CIId	Placa
1532	DAE6534
1532	DKL4586
1644	DKL7878
1644	JDM8776
1780	JJM3692
1982	DAE6534
1982	DKL4598
1982	DKL7878

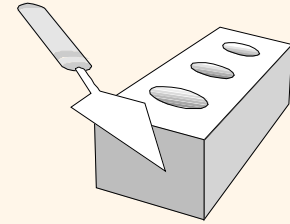
Placa
DAE6534
DKL7878

?

CIId

Divisão

SR2 / SFR



CIId	Placa
1532	DAE6534
1532	DKL4586
1644	DKL7878
1644	JDM8776
1780	JJM3692
1982	DAE6534
1982	DKL4598
1982	DKL7878

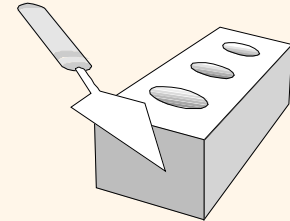
Placa
DAE6534
DKL7878

??

CIId

Divisão

SR2 / SFR



CIId	Placa
1532	DAE6534
1532	DKL4586
1644	DKL7878
1644	JDM8776
1780	JJM3692
1982	DAE6534
1982	DKL4598
1982	DKL7878

Placa
DAE6534
DKL7878

CIId
1982