


Normalização do modelo relacional

MARKETPLACE

Durante o processo de mapeamento do modelo ER/EER para o modelo relacional, observou-se que a grande maioria das tabelas resultantes já se encontrava em conformidade com a **Forma Normal de Boyce-Codd (BCNF)**. Isso se deve ao cuidado tomado na definição das entidades, atributos e relacionamentos no modelo conceitual, o que reduziu significativamente a ocorrência de redundâncias e dependências funcionais inadequadas. Entretanto, identificou-se uma exceção: a tabela **ENDERECO** apresentava uma violação da BCNF, mais detalhes sobre a sua normalização é encontrado no item 4 deste documento.

1) Tabela Usuário

A tabela já consta normalizada na forma BCNF



Normalization Tool

☒ EDIT ATTRIBUTES

☐ LEARNING RESOURCES

☐ LOAD EXAMPLE

Functions

☐ FIND A MINIMAL COVER

☐ FIND ALL CANDIDATE KEYS

☐ CHECK NORMAL FORM

☐ NORMALIZE TO 2NF


☐ NORMALIZE TO 3NF METHOD 1

☐ NORMALIZE TO 3NF METHOD 2


☐ NORMALIZE TO BCNF

About this tool


Check Normal Form



2NF
The table is in 2NF




3NF
The table is in 3NF



BCNF
The table is in BCNF

Show Steps

☐



Normalization Tool

☒ EDIT ATTRIBUTES

☐ LEARNING RESOURCES

☐ LOAD EXAMPLE

Functions

☐ FIND A MINIMAL COVER

☐ FIND ALL CANDIDATE KEYS

☐ CHECK NORMAL FORM

☐ NORMALIZE TO 2NF

☐ NORMALIZE TO 3NF METHOD 1

☐ NORMALIZE TO 3NF METHOD 2

☐ NORMALIZE TO BCNF

About this tool

Normalize to BCNF

Attributes

id

nome

cpf

email

senha

data_cadastro

Functional Dependencies

id → email

cpf → email

email → id nome cpf senha data_cadastro


Show Steps

☒

Table already in BCNF, return itself.

2) Tabela Administrador e Comprador

Por herdarem a tabela usuário, as tabelas administrado e comprador possuem apenas 1 atributo e não possuem dependências funcionais.

 **Griffith**
UNIVERSITY


Normalization Tool


☒ EDIT ATTRIBUTES
☐ LEARNING RESOURCES
☐ LOAD EXAMPLE


Functions

☐ FIND A MINIMAL COVER
☐ FIND ALL CANDIDATE KEYS
☐ CHECK NORMAL FORM
☐ NORMALIZE TO 2NF
☐ NORMALIZE TO 3NF METHOD 1
☐ NORMALIZE TO 3NF METHOD 2
☐ NORMALIZE TO BCNF
[About this tool](#)


Check Normal Form

**2NF**
The table is in 2NF

**3NF**
The table is in 3NF

**BCNF**
The table is in BCNF

Show Steps ☐

 **Griffith**
UNIVERSITY

Normalization Tool

☒ EDIT ATTRIBUTES
☐ LEARNING RESOURCES
☐ LOAD EXAMPLE

Functions

☐ FIND A MINIMAL COVER
☐ FIND ALL CANDIDATE KEYS
☐ CHECK NORMAL FORM
☐ NORMALIZE TO 2NF
☐ NORMALIZE TO 3NF METHOD 1
☐ NORMALIZE TO 3NF METHOD 2
☐ NORMALIZE TO BCNF
[About this tool](#)

Normalize to BCNF


Attributes
USUARIO_id

Functional Dependencies

Show Steps ☒

Table already in BCNF, return itself.

3) Tabela Vendedor

**Griffith**
UNIVERSITY

Normalization Tool


☒ EDIT ATTRIBUTES
☐ LEARNING RESOURCES
☐ LOAD EXAMPLE


Functions


- ☐ FIND A MINIMAL COVER
- ☐ FIND ALL CANDIDATE KEYS
- ☐ CHECK NORMAL FORM
- ☐ NORMALIZE TO 2NF
- ☐ NORMALIZE TO 3NF METHOD 1
- ☐ NORMALIZE TO 3NF METHOD 2
- ☐ NORMALIZE TO BCNF

[About this tool](#)


Check Normal Form

**2NF**
The table is in 2NF

**3NF**
The table is in 3NF

**BCNF**
The table is in BCNF

Show Steps ☐

**Griffith**
UNIVERSITY

Normalization Tool

☒ EDIT ATTRIBUTES
☐ LEARNING RESOURCES
☐ LOAD EXAMPLE

Functions

- ☐ FIND A MINIMAL COVER
- ☐ FIND ALL CANDIDATE KEYS
- ☐ CHECK NORMAL FORM
- ☐ NORMALIZE TO 2NF
- ☐ NORMALIZE TO 3NF METHOD 1
- ☐ NORMALIZE TO 3NF METHOD 2
- ☐ NORMALIZE TO BCNF

[About this tool](#)

Normalize to BCNF

Attributes
USUARIO_id ADMINISTRADOR_id status data_analise

Functional Dependencies
USUARIO_id → ADMINISTRADOR_id status data_analise

Show Steps ☒

Table already in BCNF, return itself.

4) Tabela Endereço

Durante a análise do modelo relacional, foi identificada uma violação da **Forma Normal de Boyce-Codd (BCNF)** na tabela ENDERECO. A BCNF estabelece que, para

toda dependência funcional existente em uma relação, o determinante deve ser uma superchave. No entanto, na tabela ENDERECO, foi constatada a seguinte dependência funcional:

cep → logradouro, bairro, cidade, estado

Essa dependência representa corretamente a semântica dos dados: um único **CEP** determina de forma única o logradouro, o bairro, a cidade e o estado correspondentes. Contudo, o atributo cep não é uma chave (nem superchave) da tabela ENDERECO, violando assim a definição de BCNF.


Para resolver esse problema e garantir um modelo mais consistente, **foi realizada uma decomposição da tabela ENDERECO em duas relações** distintas:

The screenshot shows a web-based database normalization tool. On the left is a red sidebar with navigation links: 'EDIT ATTRIBUTES', 'LEARNING RESOURCES', 'LOAD EXAMPLE', and a 'Functions' section with options like 'FIND A MINIMAL COVER', 'FIND ALL CANDIDATE KEYS', 'CHECK NORMAL FORM', 'NORMALIZE TO 2NF', 'NORMALIZE TO 3NF METHOD 1', 'NORMALIZE TO 3NF METHOD 2', 'NORMALIZE TO BCNF', and 'About this tool'. The main area is titled 'Normalize to BCNF' and contains two panels. The top panel shows attributes 'cep', 'logradouro', 'bairro', 'cidade', and 'estado' with a functional dependency 'cep → logradouro bairro cidade estado'. The bottom panel shows attributes 'id', 'usuario_id', 'numero', 'complemento', 'cep', 'tipo_endereco', and 'endereco_principal' with a functional dependency 'id → cep usuario_id numero complemento tipo_endereco endereco_principal'. A 'Show Steps' toggle is at the bottom right.

ENDERECO	CEP
id (PK)	cep (PK)
USUARIO_id (FK)	logradouro
numero	bairro
complemento	cidade
tipo_endereco	estado
endereco_principal	
cep	

Verificando agora se as tabelas decompostas estão na BCNF, temos:

A. Tabela Endereco



Normalization Tool

☒ EDIT ATTRIBUTES

☒ LEARNING RESOURCES

☒ LOAD EXAMPLE

Functions

☐ FIND A MINIMAL COVER

☐ FIND ALL CANDIDATE KEYS

☐ CHECK NORMAL FORM

☐ NORMALIZE TO 2NF

☐ NORMALIZE TO 3NF METHOD 1

☐ NORMALIZE TO 3NF METHOD 2

☐ NORMALIZE TO BCNF

[About this tool](#)


Check Normal Form

**2NF**
The table is in 2NF

**3NF**
The table is in 3NF

**BCNF**
The table is in BCNF

Show Steps



Normalization Tool

☒ EDIT ATTRIBUTES

☒ LEARNING RESOURCES

☒ LOAD EXAMPLE

Functions

☐ FIND A MINIMAL COVER

☐ FIND ALL CANDIDATE KEYS

☐ CHECK NORMAL FORM

☐ NORMALIZE TO 2NF

☐ NORMALIZE TO 3NF METHOD 1

☐ NORMALIZE TO 3NF METHOD 2

☐ NORMALIZE TO BCNF

[About this tool](#)

Normalize to BCNF

Attributes

id

USUARIO_id

numero

complemento

tipo_endereco

endereco_principal

cep

Functional Dependencies

id

→

USUARIO_id

numero

complemento

endereco_principal

tipo_endereco

cep

Show Steps

B. Tabela CEP

- ☒ EDIT ATTRIBUTES
- ☐ LEARNING RESOURCES
- ☐ LOAD EXAMPLE

Functions

- ☐ FIND A MINIMAL COVER
- ☐ FIND ALL CANDIDATE KEYS
- ☐ CHECK NORMAL FORM
- ☐ NORMALIZE TO 2NF
- ☐ NORMALIZE TO 3NF METHOD 1
- ☐ NORMALIZE TO 3NF METHOD 2
- ☐ NORMALIZE TO BCNF

[About this tool](#)

Check Normal Form



2NF

The table is in 2NF



3NF

The table is in 3NF



BCNF

The table is in BCNF

Show Steps



- ☒ EDIT ATTRIBUTES
- ☐ LEARNING RESOURCES
- ☐ LOAD EXAMPLE

Functions

- ☐ FIND A MINIMAL COVER
- ☐ FIND ALL CANDIDATE KEYS
- ☐ CHECK NORMAL FORM
- ☐ NORMALIZE TO 2NF
- ☐ NORMALIZE TO 3NF METHOD 1
- ☐ NORMALIZE TO 3NF METHOD 2
- ☐ NORMALIZE TO BCNF

[About this tool](#)

Normalize to BCNF

Attributes

cep logradouro bairro cidade estado

Functional Dependencies


cep → logradouro bairro cidade estado

Show Steps



Table already in BCNF, return itself.

5) Tabela Produto

**Griffith**
UNIVERSITY

Normalization Tool


☒ EDIT ATTRIBUTES
☐ LEARNING RESOURCES
☐ LOAD EXAMPLE

Functions

- ☐ FIND A MINIMAL COVER
- ☐ FIND ALL CANDIDATE KEYS
- ☐ CHECK NORMAL FORM
- ☐ NORMALIZE TO 2NF
- ☐ NORMALIZE TO 3NF METHOD 1
- ☐ NORMALIZE TO 3NF METHOD 2
- ☐ NORMALIZE TO BCNF

[About this tool](#)

**2NF**
The table is in 2NF**3NF**
The table is in 3NF**BCNF**
The table is in BCNF

**Griffith**
UNIVERSITY

Normalization Tool

☒ EDIT ATTRIBUTES
☐ LEARNING RESOURCES
☐ LOAD EXAMPLE

Functions

- ☐ FIND A MINIMAL COVER
- ☐ FIND ALL CANDIDATE KEYS
- ☐ CHECK NORMAL FORM
- ☐ NORMALIZE TO 2NF
- ☐ NORMALIZE TO 3NF METHOD 1
- ☐ NORMALIZE TO 3NF METHOD 2
- ☐ NORMALIZE TO BCNF

[About this tool](#)

Attributes


id vendedor_id nome preco descricao estoque ativo

Functional Dependencies

id → vendedor_id nome preco descricao estoque ativo

Table already in BCNF, return itself.

6) Tabela Imagem



Normalization Tool


- ☒ EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions


- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)


Check Normal Form



2NF
 The table is in 2NF




3NF
 The table is in 3NF



BCNF
 The table is in BCNF

Show Steps

☐



Normalization Tool

- ☒ EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions

- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)

Normalize to BCNF

Attributes

imagem


PRODUTO_id

Functional Dependencies

Show Steps

☐

7) Tabela Pedido



Normalization Tool


- ☒ EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions


- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)


Check Normal Form



2NF
 The table is in 2NF




3NF
 The table is in 3NF



BCNF
 The table is in BCNF

Show Steps

☐



Normalization Tool

- ☒ EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions

- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)

Normalize to BCNF

Attributes

id

COMPRADOR_id

data_pedido

status_pedido

previsao_entrega

efetivacao

total

pagamento_forma

Functional Dependencies

id

→

COMPRADOR_id

data_pedido

status_pedido

previsao_entrega

efetivacao

total


pagamento_forma

Show Steps

☒

Table already in BCNF, return itself.

8) Tabela Pedido_Produto



Normalization Tool

☒ EDIT ATTRIBUTES

☐ LEARNING RESOURCES


☐ LOAD EXAMPLE

Functions


- ☐ FIND A MINIMAL COVER
- ☐ FIND ALL CANDIDATE KEYS
- ☐ CHECK NORMAL FORM
- ☐ NORMALIZE TO 2NF
- ☐ NORMALIZE TO 3NF METHOD 1
- ☐ NORMALIZE TO 3NF METHOD 2
- ☐ NORMALIZE TO BCNF

About this tool


Check Normal Form



2NF
The table is in 2NF




3NF
The table is in 3NF



BCNF
The table is in BCNF

Show Steps

☐



Normalization Tool

☒ EDIT ATTRIBUTES

☐ LEARNING RESOURCES

☐ LOAD EXAMPLE

Functions

- ☐ FIND A MINIMAL COVER
- ☐ FIND ALL CANDIDATE KEYS
- ☐ CHECK NORMAL FORM
- ☐ NORMALIZE TO 2NF
- ☐ NORMALIZE TO 3NF METHOD 1
- ☐ NORMALIZE TO 3NF METHOD 2
- ☐ NORMALIZE TO BCNF

About this tool

Normalize to BCNF

Attributes

PEDIDO_id PRODUTO_id quantidade preco_unitario

Functional Dependencies


PEDIDO_id PRODUTO_id → quantidade preco_unitario

Show Steps

☒

Table already in BCNF, return itself.

9) Tabela Avaliação



Normalization Tool

- ☒ EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions

- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)

Check Normal Form


2NF
 The table is in 2NF

3NF
 The table is in 3NF

BCNF
 The table is in BCNF

Show Steps

☐



Normalization Tool

- ☒ EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions

- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)

Normalize to BCNF

Attributes

pedido_id

produto_id

comentario

data_avaliacao

Functional Dependencies

pedido_id

produto_id

→

comentario


data_avaliacao

Show Steps

☒

Table already in BCNF, return itself.

10)Tabela Carrinho



Normalization Tool


- ☒ EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions


- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)


Check Normal Form



2NF
 The table is in 2NF



3NF
 The table is in 3NF



BCNF
 The table is in BCNF

Show Steps

☐



Normalization Tool

- ☒ EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions

- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)

Normalize to BCNF

Attributes

id
 COMPRADOR_id


Functional Dependencies

Show Steps

☒

Table already in BCNF, return itself.

11)Tabela Carrinho_Produto



Normalization Tool


- EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions


- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

About this tool


Check Normal Form



2NF
 The table is in 2NF




3NF
 The table is in 3NF



BCNF
 The table is in BCNF

Show Steps

☐



Normalization Tool

- EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions

- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

About this tool

Normalize to BCNF

Attributes

CARRINHO_id PRODUTO_id quantidade

Functional Dependencies


CARRINHO_id PRODUTO_id → quantidade

Show Steps

☒

Table already in BCNF, return itself.

12) Tabela Lista_Pedido



Normalization Tool


☒ EDIT ATTRIBUTES
☐ LEARNING RESOURCES
☐ LOAD EXAMPLE

Functions


- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)


Check Normal Form



2NF
 The table is in 2NF




3NF
 The table is in 3NF



BCNF
 The table is in BCNF

Show Steps

☐



Normalization Tool

☒ EDIT ATTRIBUTES
☐ LEARNING RESOURCES
☐ LOAD EXAMPLE

Functions

- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)

Normalize to BCNF

Attributes

id COMPRADOR_id nome

Functional Dependencies


id → COMPRADOR_id nome

Show Steps

☒

Table already in BCNF, return itself.

13)Tabela Lista_Pedido_Produto



Normalization Tool


- ☒ EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions


- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

About this tool


Check Normal Form



2NF
 The table is in 2NF



3NF
 The table is in 3NF



BCNF
 The table is in BCNF

Show Steps

☐

- EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions

- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

About this tool

Normalize to BCNF

Attributes

LISTA_PEDIDO_id

PRODUTO_id


Functional Dependencies

Show Steps

☒

Table already in BCNF, return itself.

14) Tabela Chat



Normalization Tool


- ☒ EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions


- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)


Check Normal Form



2NF
 The table is in 2NF




3NF
 The table is in 3NF



BCNF
 The table is in BCNF

Show Steps

☐



Normalization Tool

- ☒ EDIT ATTRIBUTES
- LEARNING RESOURCES
- LOAD EXAMPLE

Functions

- FIND A MINIMAL COVER
- FIND ALL CANDIDATE KEYS
- CHECK NORMAL FORM
- NORMALIZE TO 2NF
- NORMALIZE TO 3NF METHOD 1
- NORMALIZE TO 3NF METHOD 2
- NORMALIZE TO BCNF

[About this tool](#)

Normalize to BCNF

Attributes

id

COMPRADOR_id

VENDEDOR_id

data_criacao

Functional Dependencies

id

→

COMPRADOR_id

VENDEDOR_id



data_criacao

Show Steps








☒

Table already in BCNF, return itself.

15)Tabela Mensagem

- ☒ EDIT ATTRIBUTES
-  LEARNING RESOURCES
-  LOAD EXAMPLE

Functions

-  FIND A MINIMAL COVER
-  FIND ALL CANDIDATE KEYS
-  CHECK NORMAL FORM
-  NORMALIZE TO 2NF
-  NORMALIZE TO 3NF METHOD 1
-  NORMALIZE TO 3NF METHOD 2
-  NORMALIZE TO BCNF

[About this tool](#)

Check Normal Form



2NF

The table is in 2NF



3NF

The table is in 3NF





BCNF




The table is in BCNF

Show Steps



- ☒ EDIT ATTRIBUTES
-  LEARNING RESOURCES
-  LOAD EXAMPLE

Functions

-  FIND A MINIMAL COVER
-  FIND ALL CANDIDATE KEYS
-  CHECK NORMAL FORM
-  NORMALIZE TO 2NF
-  NORMALIZE TO 3NF METHOD 1
-  NORMALIZE TO 3NF METHOD 2
-  NORMALIZE TO BCNF

[About this tool](#)

Normalize to BCNF

Attributes

id USUARIO_id CHAT_id texto data_hora

Functional Dependencies

id → CHAT_id

CHAT_id → id USUARIO_id texto data_hora

Show Steps



Table already in BCNF, return itself.