**Assignment**

Given the blank order form, order form with data, and sample data, create the 3NF relations needed to store this data in a relational database. You should follow the normalization process listed below.

Your solution should include:

- All non-aggregated data from the order form

- Each relation should have a primary key

- Include the foreign keys necessary to create the appropriate relationships

Your solution should list:

- The relational notation for all relation schemas

R(A,B,C,D,*E*)

- For each relation, list all functional dependencies using the notation:

FD1 (A,B) -> C,D,E

# Normalization Process

1. [List all attributes](#_List_all_attributes)
2. [Classify attributes into themes (entities)](#_Classify_attributes_into)
3. [Identify functional dependencies within each entity](#_Identify_functional_dependencies)
4. [Identify candidate keys for each entity](#_Identify_candidate_keys)
5. [Identify PK for each entity](#_Identify_PK_for)
6. [Identify relationships between entities](#_Identify_relationships_between)
7. [Identify FKs to implement the relationships](#_Identify_FKs_to)
8. [Ensure all entities are in 3NF. If not, normalize to 3NF](#_Ensure_all_entities)

# List all attributes

|  |
| --- |
| **Attributes** |
| OrderNumber |
| OrderDate |
| CustomerName |
| CustomerAddress |
| CustomerCity |
| CustomerState |
| CustomerZip |
| CustomerPhone |
| ~~OrderLine~~ |
| ProductNumber |
| Description |
| Quantity |
| Price |
| ~~Subtotal~~ |
| ~~Total~~ |

[To Normalization Process](#_Normalization_Process)

# Classify attributes into themes

Theme 1 – Customer

|  |
| --- |
| Attributes |
| CustomerName |
| CustomerAddress |
| CustomerCity |
| CustomerState |
| CustomerZip |
| CustomerPhone |

|  |
| --- |
| Attributes |
| ProductNumber |
| Description |
| Price |

Theme 2 – Product

Theme 3 – OrderForm

Theme 4 - ProductsOrdered

|  |
| --- |
| Attributes |
| OrderNumber |
| OrderDate |

|  |
| --- |
| Attributes |
| ProductNumber |
| Quantity |

[To Normalization Process](#_Normalization_Process)

# Identify functional dependencies with each theme

Theme 1 – Customer

CustomerName🡪CustomerAddress, CustomerCity, CustomerState, CustomerZip, CustomerPhone

Theme 2 – Product

ProductNumber🡪 Description, Price

Theme 3 – OrderForm

OrderNumber 🡪 OrderDate

Theme 4 -ProductsOrdered

ProductNumber, Quantity

[To Normalization Process](#_Normalization_Process)

# Identify candidate keys for each theme

Theme 1 – Customer

CustomerName🡪CustomerAddress, CustomerCity, CustomerState, CustomerZip, CustomerPhone

Theme 2 – Product

**ProductNumber**🡪 Description, Price

Theme 3 – OrderForm

**OrderNumber** 🡪 OrderDate

Theme 4 -ProductsOrdered

ProductNumber, Quantity

[To Normalization Process](#_Normalization_Process)

# Identify PK for each theme

Theme 1 – Customer

|  |  |
| --- | --- |
| Attributes | PK |
| CustomerID | X |
| CustomerName |  |
| CustomerAddress |  |
| CustomerCity |  |
| CustomerState |  |
| CustomerZip |  |
| CustomerPhone |  |

|  |  |
| --- | --- |
| Attributes | PK |
| ProductNumber | X |
| Description |  |
| Price |  |

Theme 2 – Product

Theme 3 OrderForm

|  |  |
| --- | --- |
| Attributes | PK |
| OrderNumber | X |
| OrderDate |  |

Theme 4 -ProductsOrdered

|  |  |
| --- | --- |
| Attributes | PK |
| ProductNumber | X |
| Quantity | X |
| OrderNumber | X |

[To Normalization Process](#_Normalization_Process)

# Identify relationships between themes

Theme 1 – Customer

|  |  |
| --- | --- |
| Attributes | PK |
| CustomerID | X |
| CustomerName |  |
| CustomerAddress |  |
| CustomerCity |  |
| CustomerState |  |
| CustomerZip |  |
| CustomerPhone |  |

Related to OrderForm

|  |  |
| --- | --- |
| Attributes | PK |
| ProductNumber | X |
| Description |  |
| Price |  |

Theme 2 – Product

Related to ProductsOrdered

Theme 3 OrderForm

|  |  |
| --- | --- |
| Attributes | PK |
| OrderNumber | X |
| OrderDate |  |

Related to Customer, ProductsOrdered

Theme 4 -ProductsOrdered

|  |  |
| --- | --- |
| Attributes | PK |
| ProductNumber | X |
| Quantity | X |
| OrderNumber | X |

Related to Product, OderForm

[To Normalization Process](#_Normalization_Process)

# Identify FKs to implement the relationships

Theme 1 – Customer

|  |  |  |
| --- | --- | --- |
| Attributes | PK | FK |
| CustomerID | X |  |
| CustomerName |  |  |
| CustomerAddress |  |  |
| CustomerCity |  |  |
| CustomerState |  |  |
| CustomerZip |  |  |
| CustomerPhone |  |  |

Related to OrderForm

|  |  |  |
| --- | --- | --- |
| Attributes | PK | FK |
| ProductNumber | X |  |
| Description |  |  |
| Price |  |  |

Theme 2 – Product

Related to ProductsOrdered

Theme 3 OrderForm

|  |  |  |
| --- | --- | --- |
| Attributes | PK | FK |
| OrderNumber | X |  |
| OrderDate |  |  |
| CustomerID |  | X |

Related to Customer, ProductsOrdered

Theme 4 -ProductsOrdered

|  |  |  |
| --- | --- | --- |
| Attributes | PK | FK |
| ProductNumber | X | X |
| Quantity | X |  |
| OrderNumber | X | X |

Related to Product, OderForm

[To Normalization Process](#_Normalization_Process)

# Ensure all entities are in 3NF. If not, normalize to 3NF

Theme 1 – Customer

CUSTOMER(CUSTOMERID, CUSTOMERNAME, CUSTOMERADDRESS, CUSTOMERCITY, CUSTOMERSTATE, CUSTOMERZIP, CUSTOMERPHONE)

FD1: CustomerID 🡪 CustomerName,CustomerAddress, CustomerCity, CustomerState, CustomerZip, CustomerPhone

Theme 2 – Product

PRODUCT(PRODUCTNUMBER,DESCRIPTION, PRICE)

FD2: ProductNumber🡪 Description, Price

Theme 3 – OrderForm

ORDERFORM(ORDERNUMBER, ORDERDATE, *CUSTOMERID*)

OrderNumber 🡪 OrderDate, CustomerID

Theme 4 -ProductsOrdered

PRODUCTSORDERED(*PRODUCTNUMBER*, QUANTITY, *ORDERNUMBER*)

[To Normalization Process](#_Normalization_Process)

Order Form Order Number \_\_\_\_\_\_\_\_

Order Date \_\_\_\_\_\_\_\_\_\_\_\_\_

**Customer Name**:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Street Address**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**City:**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**State:**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Zip Code:**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Customer Phone Number**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| OrderLine | Product # | Description | Quantity | Price | Subtotal |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
|  |  |  |  | Total |  |

Order Form Order Number \_\_101\_\_\_

Order Date \_\_\_\_\_3/17/2017\_

**Customer Name**:\_\_\_\_ACME, Inc.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Street Address**: \_\_\_ 123 Front St\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**City:**\_\_\_\_\_\_\_\_\_\_\_\_ Ellensburg\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**State:**\_\_\_\_\_\_\_WA\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Zip Code:**\_\_\_\_\_\_\_98926\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Customer Phone Number**: \_\_\_ 509-555-1212\_\_\_\_\_\_

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| OrderLine | Product # | Description | Quantity | Price | Subtotal |
| 1 | 1 | Widgets | 4 | 20 | 80 |
| 2 | 2 | Thingamajigs | 4 | 22 | 88 |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
|  |  |  |  | Total | 168 |

**Sample Data**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Order Number | Order Date | Customer Name | Street Address | City | State | Zip | Phone | Product# |
| 101 | 3/17/2017 | ACME, Inc | 123 Front St | Ellensburg | WA | 98926 | 509-555-1212 | 1 |
| 102 | 3/30/2017 | ABC Corp | 456 Second St | Ellensburg | WA | 98926 | 509-555-9999 | 2 |
| 103 | 4/4/2017 | XYZ, LLC | 5 Third St | Seattle | WA | 98101 | 206-555-1111 | 4 |
| 104 | 4/5/2017 | ACME, Inc | 123 Front St | Ellensburg | WA | 98926 | 509-555-1212 | 4 |

**Sample Data (columns to the right of the above table)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Description | Quantity | Price | Product# | Description | Quantity | Price | Product# | Description |
| Widgets | 4 | 20 | 2 | Thingmajigs | 4 | 22 |  |  |
| Thingmajigs | 5 | 22 | 4 | Cups | 2 | 30 | 3 | Dohickey |
| Cups | 14 | 30 | 2 | Thingmajigs | 12 | 22 | 1 | Widgets |
| Cups | 2 | 30 | 5 | Straws | 100 | 2 | 2 | Thingmajigs |

**Sample Data (columns to the right of the above tables)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Quantity | Price | Product# | Description | Quantity | Price |
|  |  |  |  |  |  |
| 2 | 122 | 5 | Straws | 100 | 2 |
| 4 | 20 |  |  |  |  |
| 4 | 22 |  |  |  |  |