# ISTE-608 Database Design and Implementation

## Homework # 4 – Normalization

DUE: Sunday, September 30, 2018 by 11:59pm
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**Submit this document edited to include your answers, for the six tasks, to the HW#4 Dropbox by the stated deadline.**

**Task #1 (12 points)**
MUSIC(Title, Artist, NumGrpMembers, Year, Producer, ProducerURL, Category, CategorySales, Media, MediaPrice )

Business Rules:

1. Each "album" (CD) is uniquely identified by its title. Note that, for the rest of the business rules, the "Title" attribute of MUSIC refers to the name of the "album". This just informs us that whenever the word "album" is used it represents a "title".
2. An artist may either be a single person or a band made up of multiple members (the count being recorded in NumGrpMembers, which can be 1).
3. Each album has one release year.
4. Each album is produced by one music production company (producer).
5. Each producer has one company URL.
6. A specific album has only one artist.
7. Each album is classified into one music category (Rock, Country, etc.)
8. Each category is associated with one category sales value, which is the year-to-date sales for that given category.
9. For convenience, the music company sells all of its music at the same price based on the media type. For example, all cassettes are $9.99, all CDs are $16.99, etc.

List the **functional** dependencies for the MUSIC relation above, according only to the business rules listed. Use the format A □ B. Then, for each functional dependency denote with a 'Y' or 'N' if the respective functional dependency causes a partial dependency or transitive dependency violation in the MUSIC relation.

| Functional Dependencies | Partial Dependency? | Transitive Dependency? |
|---|---|---|
| **Artist -> NumGrpMembers** | **N** | **Y** |
| **Title -> Year** | **Y** | **N** |
| **Title -> Producer** | **Y** | **N** |
| **Producer -> ProducerURL** | **N** | **Y** |
| **Title -> Artist** | **Y** | **N** |
| **Title -> Category** | **Y** | **N** |
| **Category -> CategorySales** | **N** | **Y** |
| **Media -> MediaPrice** | **Y** | **N** |

**Commented [1]:** An example completed for you based on business rule #2.

**Task #2 (9 points)**

For the relation below, state the *highest* normal form the relation is in, the reason, **and** if necessary normalize the relation, and all resulting relations, through BCNF. Use proper relational notation and include reference statements for any foreign keys.

1. Q1( a, b, c, d )

Functional Dependencies:
a, b → c, d
c → d

**YOUR ANSWER (Highest normal form the relation is currently in):**
- 2NF

**YOUR ANSWER (Final set of relations normalized to BCNF):**
- Q1(a, b, *c*)
  Q1(c) mei Q2(c)
- Q2(c,d)

**Task #3 (12 points)**

For the relation below, determine the *highest* normal form the relation is in, the reason, **and** if necessary normalize the relation, and all resulting relations, through BCNF. Use proper relational notation and include reference statements for any foreign keys.
Q2(a, b, c, d)

Functional dependencies:
a, b → c, d
a → c
b → d

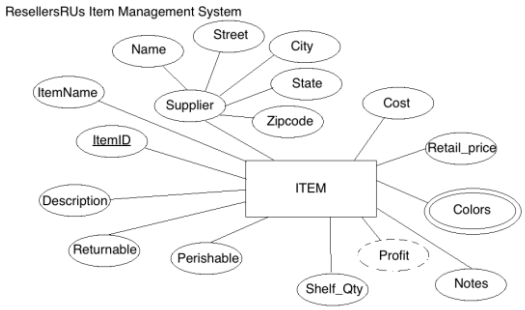
**YOUR ANSWER (Highest normal form the relation is currently in):**
- 1 NF

**YOUR ANSWER (Final set of relations normalized to BCNF):**
- Q2(*a*,*b*)
  Q2(a) mei Q3(a)
  Q2(b) mei Q4(b)

- Q3(a,c)
- Q4(b,d)

**Task #4 (17 points)**

Given the E-R diagram, the resulting relation, and the functional dependencies below, normalize the ITEM relation and resulting relations through BCNF. Be sure to use proper relational notation and reference statements for foreign keys.




Resulting Relation:
ITEM(ItemID, ItemName, Name, Street, City, State, Zipcode, Cost, Retail_price, Color1, Color2, Notes, Shelf_Qty, Perishable, Returnable, Description)

Functional Dependencies:
ItemID ➔ ItemName, Name, Street, City, State, Zipcode, Cost, Retail_price, Color1, Color2, Notes, Shelf_Qty, Perishable, Returnable, Description

Name ➔ Street, City, State, Zipcode

**YOUR ANSWER (Final set of relations normalized to BCNF):**

- Item(ItemID, *ItemName*, *Name*, Cost, Retail_Price, Notes, Shelf_Qty, Perishable, Returnable, Description)

Item(ItemName) mei Item_Color(ItemName)
Item(Name) mei Item_Supplier(Name)

- Item_Color(ItemName, Color1, Color2)

- Item_Supplier(Name, Street, City, State, Zipcode)

**Task #5 (23 points)**

Given the relation and functional dependencies below, normalize the SALE relation and resulting relations through BCNF. Be sure to use proper relational notation and reference statements for foreign keys.

SALE(Invoice#, Item#, CustID, CustName, CustAddress, ItemName, ItemPrice, ItemQtyPurch, Salesperson#, SalespersonName, Subtotal, Tax, TotalDue)

Functional Dependencies:
Invoice#, Item# ➔ CustID, CustName, CustAddress, ItemName, ItemPrice, ItemQtyPurch, Salesperson#, SalespersonName, Subtotal, Tax, TotalDue

Item# ➔ ItemName, ItemPrice

Invoice# ➔ CustID, CustName, CustAddress, Salesperson#, SalespersonName, Subtotal, Tax, TotalDue

CustID ➔ CustName, CustAddress

Salesperson# ➔ SalespersonName

**YOUR ANSWER (Final set of relations normalized to BCNF):**

- SALE(*Invoice#*, *Item#*, *CustID*, ItemQtyPurch, *Salesperson#*, Subtotal, Tax, TotalDue)

SALE(Invoice#) mei SALE_INVOCE_DETAILS(Invoice#)
SALE(Item#) mei SALE_ITEM_DETAILS(Item#)
SALE(CustID) mei CUST_DETAILS(CustID)
SALE(Salesperson#) mei SALES_PERSON_DETAILS(Salesperson#)

- SALE_INVOICE_DETAILS(Invoice#, *CustID, Salesperson#*, Subtotal, Tax, TotalDue)

SALE_INVOICE_DETAILS(CustID) mei CUST_DETAILS(CustID)
SALE_INVOICE_DETAILS(Salesperson#) mei SALES_PERSON_DETAILS(Salesperson#)

- SALE_ITEM_DETAILS(Item#, ItemName, ItemPrice)

- CUST_DETAILS(CustID, CustName, CustAddress)

- SALES_PERSON_DETAILS(Salesperson#, SalespersonName)

**Task #6 (27 points)**

Given the relation and functional dependencies below, normalize the relation and resulting relations through BCNF. Be sure to use proper relational notation and reference statements for foreign keys.

2. A(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)

Functional Dependencies:
1, 2, 3, 4->5, 6, 7, 8, 9, 10
1->5, 6
5->1,6
2,3->7,8
7->8
4->9,10
9->10
10->9

**YOUR ANSWER (Final set of relations normalized to BCNF):**

- A(*1, 2, 3, 4, 5, 7, 9)*

  A(1) mei C(1)
  A(2,3) mei B(2,3)
  A(4) mei D(4)
  A(5) mei E(5)
  A(7) mei F(7)
  A(9) mei G(9)

- B(2, 3, *7*)

  B(7) mei F(7)

- C(1, *5*)

  C(5) mei E(5)

- D(4, *9*)

  D(9) mei G(9)

- E(5, 6)

- F(7, 8)

- G(9, 10)