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Databases with MySQL

Exercises
DATA NORMALIZATION

(solutions)

By Cristina Rodrigues

1. The following image is a Health History Report from a pet hospital. Normalize the data to the 3rd Normal Form (3FN).

HEALTH HISTORY REPORT

PET ID	PET NAME	PET TYPE	PET AGE	OWNER	VISIT DATE	PROCEDURE
246	ROVER	DOG	12	SAM COOK	JAN 13/2002	01 - RABIES VACCINATION
					MAR 27/2002	10 - EXAMINE and TREAT WOUND
					APR 02/2002	05 - HEART WORM TEST
298	SPOT	DOG	2	TERRY KIM	JAN 21/2002	08 - TETANUS VACCINATION
					MAR 10/2002	05 - HEART WORM TEST
341	MORRIS	CAT	4	SAM COOK	JAN 23/2001	01 - RABIES VACCINATION
					JAN 13/2002	01 - RABIES VACCINATION
519	TWEEDY	BIRD	2	TERRY KIM	APR 30/2002	20 - ANNUAL CHECK UP
					APR 30/2002	12 - EYE WASH

UNF:

Pet [pet_id, pet_name, pet_type_id, pet_type_description, pet_birth_date, owner_id, owner_name, {visitdate, procedure_no, procedure_name}]

note:
** since the owner is an entity who may have many pets, the attribute owner_id was added;*

** there are many pets of the same type therefore pet_type_id was also added;*

** pet_age is a static data item, the age of the pet is dynamic and is calculated by the birth date, therefore the attribute pet_birth_date shhould be stored in the database*

1NF:

Pet [pet_id, pet_name, pet_type_id, pet_type_description, pet_birth_date, owner_id, owner_name]

Pet_Visit [pet_id, visitdate, procedure_no, procedure_name]

note:
**A procedure may occur on multiple dates, therefore visitdate is included as part of the primary key*

2NF:

Pet [pet_id, pet_name, pet_type_id, pet_type_description, pet_birth_date, owner_id, owner_name]

Pet_Visit [pet_id, visitdate, procedure_no]

Procedure [procedure_no, procedure_name]

3NF:

Pet [pet_id, pet_name, pet_type_id, pet_birth_date, owner_id]

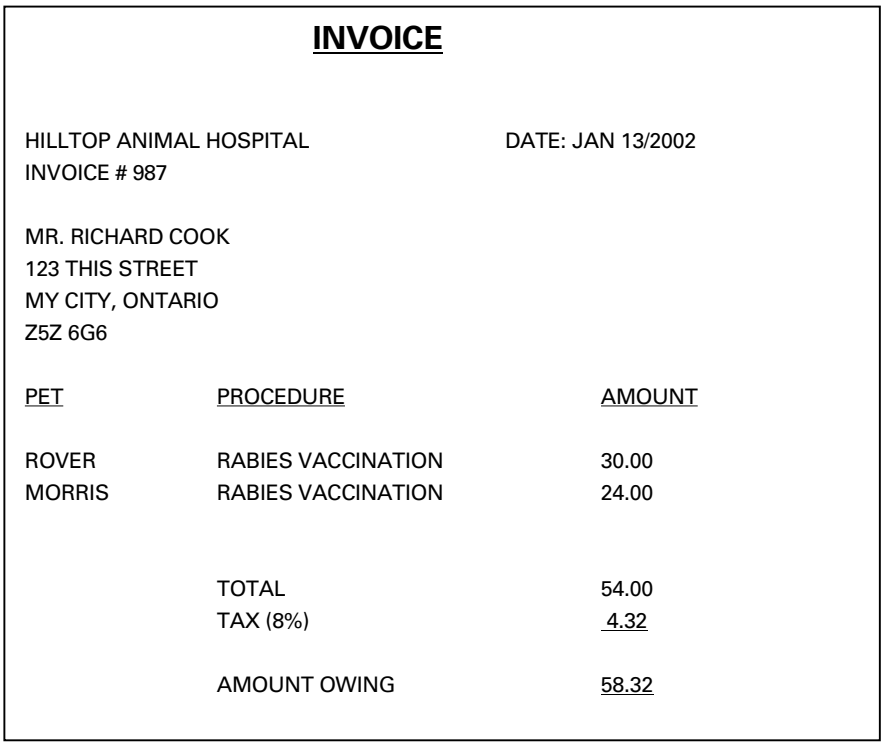
Pet_Visit [pet_id, visitdate, procedure_no]

Procedure [procedure_no, procedure_name]

Owner [owner_id, owner_name]

Pet_type [pet_type_id, pet_type_description]

2. The following image is an Invoice from a pet hospital. Normalize the data to the 3rd Normal Form (3FN).



INVOICE

HILLTOP ANIMAL HOSPITAL
INVOICE # 987

DATE: JAN 13/2002

MR. RICHARD COOK
123 THIS STREET
MY CITY, ONTARIO
Z5Z 6G6

PET	PROCEDURE	AMOUNT
ROVER	RABIES VACCINATION	30.00
MORRIS	RABIES VACCINATION	24.00
	TOTAL	54.00
	TAX (8%)	4.32
	AMOUNT OWING	58.32

UNF:

Invoice [invoice_no, invoice_date, owner_id, owner_name, owner_addr, {pet_id, pet_name, procedure_id, procedure_name, amount}]

note:
** since there may be many pets with the same name, the attribute pet_id was added;*

** since there may be many owners with the same name, the attribute owner_id was added;*

** since the procedure is an entity that may be executed on many pets, the attribute procedure_id was added;*

1NF:

Invoice [invoice_no, invoice_date, owner_id, owner_name, owner_addr]

Invoice_pet_procedure [invoice_no, pet_id, , procedure_id, pet_name, procedure_name, amount]

note:
** pet_id and procedure_id were chosen as part of the primary key because the same procedure may be executed on different pets.*

2NF:

Invoice [invoice_no, invoice_date, owner_id, owner_name, owner_addr]

Invoice_pet_procedure [invoice_no, pet_id, , procedure_id, amount]

Pet [pet_id, pet_name]

Procedure [procedure_id, pet_name]

3NF:

Invoice [invoice_no, invoice_date, owner_id]

Invoice_pet_procedure [invoice_no, pet_id, , procedure_id, amount]

Pet [pet_id, pet_name]

Procedure [procedure_id, pet_name]

Owner [owner_id, owner_name, owner_addr]

3. The following images are users views of an art gallery. Normalize the data in the users view to the 3rd Normal Form (3FN).

   The Gill Art Gallery wishes to maintain data on their customers, artists and paintings. They may have several paintings by each artist in the gallery at one time. Paintings may be bought and sold several times. In other words, the gallery may sell a painting, then buy it back at a later date and sell it to another customer.

Gallery Customer History Form

Customer

Jackson, Maria Phone (206) 284-6783
123 – 4th Avenue
Lisbon, RB
12345

Purchases Made

Artist	Title	Purchase Date	Sales Price
03 - Carol Channing	Laugh with Teeth	09/17/2000	7000.00
15 - Dennis Frings	South toward Emerald Sea	05/11/2000	1800.00
03 - Carol Channing	At the Movies	02/14/2002	5550.00
15 - Dennis Frings	South toward Emerald Sea	07/15/2003	2200.00

UNF:

Customer [customer_id, customer_name, customer_address, customer_city, customer_state, customer_zip_code, customer_phone, {artist_id, artist_name, art_id, art_title, purchace_date, price}]

1NF:

Customer [customer_id, customer_name, customer_address, customer_city, customer_state, customer_zip_code, customer_phone]

Customer_art [customer_id, art_id, purchace_date, artist_id, artist_name, , art_title, , price]

note:

**the primary key chosen for the repeating group is the piece of art itself (a code was assigned), however because a piece of art may be bought by a customer more than once, the purchase date was added as part of the key to make the rows unique.*

2NF:

Customer [customer_id, customer_name, customer_address, customer_city, customer_state, customer_zip_code, customer_phone]

Customer_art [customer_id, art_id, purchace_date, price]

Art [art_id, art_title, artist_id, artist_name]

3NF:

Customer [customer_id, customer_name, customer_address, customer_zip_code, customer_phone]

Customer_art [customer_id, art_id, purchace_date, price]

Art [art_id, art_title, artist_id]

Zip_codes_us [zip_code, city, state, country]

Art [artist_id, artist_name]

4. The following images are users views of a Manufacturing Company. Normalize the data in the users view to the 3rd Normal Form (3FN).

SAMPLE REPORTS AND SCREENS

XYZ MANUFACTURING ORDER FORM DATE: AUG 30, 2022

ORDER NUMBER: 9932
MR. X. Y. SMITH
123 NARVON STREET
NEW YORK, NEW YORK
30011

SHIPPING ADDRESS: 456 HUDSON STREET
NEW YORK, NEW YORK
30000

PHONE: (416) 879-0045 (416) 786-3241

CUSTOMER DISCOUNT: 3%

ITEM #	PRODUCT CODE	DESCRIPTION	QTY	BACKORDERED	FILLED	PRICE/UNIT	TOTAL AMOUNT
1	FR223	HALF SIZE REFRIGERATOR	2	0	2	750.99	1501.98
2	TB101	PATIO TABLE	5	2	3	150.00	450.00
3	CH089	PATIO CHAIRS	20	0	20	35.00	700.00

TOTAL 2651.98
DISCOUNT AMT 79.56

AMOUNT OWING 2572.42

PRODUCTS INVENTORY AS AT: AUG 30, 2022

PRODUCT CODE	DESCRIPTION	QTY ON HAND	QTY BACKORDERED	PRICE
CH089	PATIO CHAIRS	140	0	35.00
FR223	HF SIZE REFRIGERATOR	10	0	750.99
TB101	PATIO TABLE	0	2	35.00
	.			
	.			
	.			

XYZ MANUFACTURING
PRODUCT MANUFACTURING REPORT

PRODUCT CODE	DESCRIPTION	PART NUMB.	PART DESCRIPTION	QTY REQUIRED
CH089	PATIO CHAIRS	WOOD223	1 X 2 - 30" WOOD	8
		SCRW110	1.25" SCREWS	26
		.		
		.		
		.		
TB101	PATIO TABLE	WOOD995	2 X 4 - 48" WOOD	12
		SCRW110	1.25" SCREWS	34
		.		
		.		
		.		

View 1 - Product Order

UNF:

Order [order number ,order_date, customer_id, customer_name, customer_address, customer_city, customer_state, customer_zip_code, shipping_address, shipping _city, shipping _state, shipping _zip_code, customer_phone1, customer_phone2, customer_discount, {product_id, prod_description, quantity_ordered, quantity_filled, unit_price}, order_total, order_discount]

note:
** order amount owing is not included as an attibue be cause it may derived from order_total and order_discount*

** the item_number is not an attribute because it is only a part of the order report. It does not identify the product.*

**customer_id was added because there may be many customers with the same name*

1NF:

Order [order number ,order_date, customer_id, customer_name, customer_address, customer_city, customer_state, customer_zip_code, shipping_address, shipping _city, shipping _state, shipping _zip_code, customer_phone1, customer_phone2, customer_discount, order_total, order_discount]

Order_product [order_number, product_id, prod_description, quantity_ordered, quantity_filled, unit_price]

2NF:

Order [order_number ,order_date, customer_id, customer_name, customer_address, customer_city, customer_state, customer_zip_code, shipping_address, shipping _city, shipping _state, shipping _zip_code, customer_phone1, customer_phone2, customer_discount, order_total, order_discount]

Order_product [order_number, product_id, quantity_ordered, quantity_filled, unit_price_applied_on_order]

Product [product_id, prod_description, product_unit_price]

note:

* unit_price_applied_on_order should be used as an attribute because it may not be the same as the current unit_price

3NF:

Order [order_number ,order_date, customer_id, order_total, order_discount]

Order_product [order_number, product_id, quantity_ordered, quantity_filled, unit_price_applied_on_order]

Product [product_id, prod_description, product_unit_price]

Zip_codes_us [zip_code, city, state, country]

Customer [customer_id, customer_name, customer_address, customer_zip_code, shipping_address, shipping _zip_code, customer_phone1, customer_phone2, customer_discount]

View 2 - Product Inventory List

UNF:

Product [product_id, product_description,poduct_qt_onhand, product_qt_backordered, product_unit_price]

note:
** As can be observed the product table is in 3FN. We will now analyse users view 1, and we can observe that we have added to attributes to the Product table (poduct_qt_onhand, product_qt_backordered).*

View 3 - Product Manufacturing Report

UNF:

Product [product_id, product_description, {part_number, part_description, qt_required}]

1NF:

Product [product_id, product_description, {part_number, part_description, qt_required}]

Product_part [product_id, part_number, part_description, qt_required]

2NF:

Product [product_id, product_description]

Product_part [product_id, part_number, qt_required]

Part [part_number, part_description]

3NF:

same as 2NF

note:
** As can be observed the product table is in 3FN. We will now analyse users view 1 and users view 2, and we can observe that we have missing attributes that were added in the preview views to the Product table (poduct_qt_onhand, product_qt_backordered, product_unit_price). These attributes must be kept on the product table.*

Product [product_id, product_description, **poduct_qt_onhand**, **product_qt_backordered**, **product_unit_price**]

Product_part [product_id, part_number, qt_required]

Part [part_number, part_description]

Final version of database (all tables of all the users views)

Order [order_number ,order_date, customer_id, order_total, order_discount]

Order_product [order_number, product_id, quantity_ordered, quantity_filled, unit_price_applied_on_order]

Zip_codes_us [zip_code, city, state, country]

Customer [customer_id, customer_name, customer_address, customer_zip_code, shipping_address, shipping _zip_code, customer_phone1, customer_phone2, customer_discount]

Product [product_id, product_description, poduct_qt_onhand, product_qt_backordered, product_unit_price]

Product_part [product_id, part_number, qt_required]

Part [part_number, part_description]

5. The following images are users views of a Grocery Store. Normalize the data in the users view to the 3rd Normal Form (3FN).

Good News Grocers

User View - Price Update List

Department	Product Code	Aisle Number	Price	Unit of Measure
Produce	4081	1	0.35	lb
Produce	4027	1	0.90	ea
Produce	4108	1	1.99	lb
Butcher	331100	5	1.50	lb
Butcher	331105	5	2.40	lb
Butcher	332110	5	5.00	lb
Freezer	411100	6	1.00	ea
Freezer	521101	6	1.00	ea
Freezer	866503	6	5.00	ea
Freezer	866504	6	5.00	ea

This report is used by the department managers to update the prices that are displayed in the gocery store for these products.

UNF:

product [product_code, {department_id, department_name}, {aisle_number, aisle_description}, price, unit_of_measure_id, unit_of_measure_name]

1NF:

product [product_code, price, unit_of_measure_id, unit_of_measure_name]

product_department [product_code, department_id, department_name]

product_isle [product_code, aisle_number, aisle_description]

2NF:

product [product_code, price, unit_of_measure_id, unit_of_measure_name]

product_department [product_code, department_id]

product_isle [product_code, aisle_number]

Department [department_id, department_name]

Aisle [aisle_number, aisle_description]

3NF:

product [product_code, price, unit_of_measure_id, unit_of_measure_name]

product_department [product_code, department_id]

product_isle [product_code, aisle_number]

Department [department_id, department_name]

Aisle [aisle_number, aisle_description]

Unit_of_measure [unit_of_measure_id, unit_of_measure_name]

Note:
**It may be debatable whether department actually determines aisle number. This may be true in a small grocery store but in a large grocery store, products from a department may be found in multiple aisles. This should be discussed with your database client to determine their exact needs.*