

CZ2007 LAB 3

INTRODUCTION TO DATABASE

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1 CREDIT_CARD

CREDIT_CARD (card_num, bank, date_valid_to, date_valid_from, customer_id)

Keys: card_num

Primary Key: card_num

FDs: $\text{card_num} \rightarrow \text{bank, date_valid_to, date_valid_from, customer_id}$

All the attributes are functionally dependent on solely the Primary Key (card_num)

\therefore The relation is in 3NF

2 CUSTOMER

CUSTOMER (customer_id, username, email, password, full_name, address, phone_num)

Keys: customer_id, username, email

Primary Key: customer_id

FDs:

$\text{customer_id} \rightarrow \text{username, email, password, full_name, address, phone_num}$

$\text{username} \rightarrow \text{customer_id, email, password, full_name, address, phone_num}$

$\text{email} \rightarrow \text{username, customer_id, password, full_name, address, phone_num}$

$\text{phone_num} \rightarrow \text{full_name, address}$

\therefore The relation is **not** in 3NF

3NF Procedures:

Minimal Basis for R:

CUSTOMER (customer_id(A), username(B), email(C), password(D), full_name(E),
address(F), phone_num(G))

= CUSTOMER(A,B,C,D,E,F,G)

KEYS: A,B,C

FDS: $A \rightarrow BCDEFG, B \rightarrow ACDEFG, C \rightarrow BADEFG$
 $, G \rightarrow EF$

STEP 1:

$A \rightarrow B, A \rightarrow C, A \rightarrow D, A \rightarrow E, A \rightarrow F, A \rightarrow G$

$B \rightarrow A, B \rightarrow C, B \rightarrow D, B \rightarrow E, B \rightarrow F, B \rightarrow G$

$C \rightarrow A, C \rightarrow B, C \rightarrow D, C \rightarrow E, C \rightarrow F, C \rightarrow G$

$G \rightarrow E, G \rightarrow F$

STEP 2:

we remove

$B \rightarrow A, B \rightarrow C, B \rightarrow D, B \rightarrow E, B \rightarrow F, B \rightarrow G$

$C \rightarrow A, C \rightarrow B, C \rightarrow D, C \rightarrow E, C \rightarrow F, C \rightarrow G$

$A \rightarrow E, A \rightarrow F$

$\{A\}^+ = \{ABCDEFG\}$

$A \rightarrow B, A \rightarrow C, A \rightarrow D, A \rightarrow G, G \rightarrow E, G \rightarrow F$

$\therefore B \rightarrow A, B \rightarrow C, B \rightarrow D, B \rightarrow E, B \rightarrow F, B \rightarrow G$

$C \rightarrow A, C \rightarrow B, C \rightarrow D, C \rightarrow E, C \rightarrow F, C \rightarrow G$

$A \rightarrow E, A \rightarrow F$ is redundant

STEP 3: No FD have redundant attributes on LHS

$A \rightarrow B, A \rightarrow C, A \rightarrow D, A \rightarrow G$

$G \rightarrow E, G \rightarrow F$

3NF:

$A \rightarrow BCDG \quad G \rightarrow EF$

$R_1(ABCDG) = R_1(\text{customer_id, username, email, password, phone_num})$

$R_2(GEF) = R_2(\text{phone_num, full_name, address})$

\therefore The relation is in 3NF

3 ORDER

ORDER (order_id, date, status, customer_id)

Keys: order_id

Primary Key: order_id

FDs: order_id \rightarrow date, status, customer_id

All the attributes are functionally dependent on solely the Primary Key (order_id)

\therefore The relation is in 3NF

4 ORDER_ITEM

ORDER_ITEM (sequence_num(A), order_id(B), product_unit_price(C), quantity(D), status(E), product_id(F), shipment_id(G))

Keys: {sequence_num(A), order_id(B)}

Primary Key: {sequence_num(A), order_id(B)}

FDs: AB \rightarrow CDEFG F \rightarrow C

F \rightarrow C violates 3NF (F is not a superkey, C is not contained in a key)

Step 1: Find minimal Basis

Step 1.1 (Keep RHS only 1 attribute):

AB \rightarrow C, AB \rightarrow D, AB \rightarrow E, AB \rightarrow F, AB \rightarrow G, F \rightarrow C

Step 1.2 (Remove redundant FD):

AB \rightarrow D, AB \rightarrow E, AB \rightarrow F, AB \rightarrow G, F \rightarrow C

Step 1.3 (Remove redundant attributes on LHS):

AB \rightarrow D, AB \rightarrow E, AB \rightarrow F, AB \rightarrow G, F \rightarrow C

Step 2: Combine FDs whose LHS are same):

AB \rightarrow DEFG, F \rightarrow C

Step 3: Create a table for each FD:

$R_1(A, B, D, E, F, G)$, $R_2(F, C)$

Step 4: $R_2(F, C)$ is redundant with PRODUCT table, so we need to remove R_2

\therefore Final Answer: R(A, B, D, E, F, G)

ORDER_ITEM (sequence_num(A), order_id(B), quantity(D), status(E), product_id(F), shipment_id(G))

All the attributes are functionally dependent on solely its

Primary Key {sequence_num(A), order_id(B)}

\therefore The relation is in 3NF

5 PRODUCT_TYPE

PRODUCT_TYPE (product_type_id, description, parent_product_type_id)

Keys: product_type_id

Primary Key: product_type_id

FDs: product_type_id \rightarrow description, parent_product_type_id

All the attributes are functionally dependent on solely its Primary Key(product_type_id)
 \therefore The relation is in 3NF

6 RESTRICTED_TO

RESTRICTED_TO (shop_id, product_type_id)

Keys: {shop_id, product_type_id}

Primary Key: {shop_id, product_type_id}

FDs: shop_id, product_type_id \rightarrow shop_id, product_type_id

Only trivial FD exists in the relation
 \therefore The relation is in 3NF

7 SHIPMENT

SHIPMENT (shipment_id, tracking_num, date, invoice_number)

Keys: shipment_id, tracking_num

Primary Key: shipment_id

FDs: shipment_id \rightarrow tracking_num, date, invoice_number

All the attributes are functionally dependent on solely its Primary Key(shipment_id)
 \therefore The relation is in 3NF

8 INVOICE

INVOICE(invoice_number, date, status, order_id)

Keys: invoice_number

Primary Key: invoice_number

FDs: invoice_number \rightarrow date, status, order_id

All the attributes are functionally dependent on solely its Primary Key(invoice_number)
 \therefore The relation is in 3NF

9 PAYMENT

PAYMENT (payment_id, amount, card_num,invoice_number)

Keys: payment_id

Primary Key: payment_id

FDs: payment_id \rightarrow amount,card_num,invoice_number

All the attributes are functionally dependent on solely its Primary Key(payment_id)

\therefore The relation is in 3NF

10 PRODUCT

PRODUCT(product_id,name,colour,price,size,description,shop_id,product_type_id)

Keys: product_id

Primary Key: product_id

FDs: product_id \rightarrow name,colour,price,size,description,shop_id,product_type_id

All the attributes are functionally dependent on solely its Primary Key(payment_id)

\therefore The relation is in 3NF

11 PRODUCT_PHOTO

PRODUCT_PHOTO(photo_sequence,product_id,pic)

Keys: {photo_sequence, product_id}

Primary Key: {photo_sequence,product_id}

FDs: photo_sequence,product_id \rightarrow pic

All the attributes are functionally dependent on solely its
Primary Key (photo_sequence,product_id)

\therefore The relation is in 3NF

12 SHOP

SHOP (shop_id, shop_name)

Keys: shop_id

Primary Key: shop_id

FDs: shop_id \rightarrow shop_name

All the attributes are functionally dependent on solely its
Primary Key (shop_id)

\therefore The relation is in 3NF

13 ERD REFERENCE

