CZ2007 LAB 3
INTRODUCTION TO DATABASE

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

   Keys: card_num

   Primary Key: card_num

   FDs: card_num → bank, date_valid_to, date_valid_from,customer_id

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

   ∴ The relation is in 3NF

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

   Keys: customer_id,username, email

   Primary Key: customer_id

   FDs:

   customer_id → username, email,password, full_name,address,phone_num

   username → customer_id , email,password, full_name,address,phone_num

   email → username, customer_id,password, full_name,address,phone_num

   phone_num →full_name, address

   ∴The relation is **not** in 3NF

   3NF Procedures:

   Mninimal 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→BCDEFG, B→ACDEFG, C→BADEFG
   , G→EF

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STEP 1:

A→B, A→C, A→D, A→E, A→F, A→G

B→A, B→C, B→D, B→E, B→F, B→G

C→A, C→B, C→D, C→E, C→F, C→G

G→E, G→F

STEP 2:

we remove

B→A, B→C, B→D, B→E, B→F, B→G

C→A, C→B, C→D, C→E, C→F, C→G

A→E, A→F

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

A→B, A→C, A→D, A→G, G→E, G→F

∴ B→A, B→C, B→D, B→E, B→F, B→G

C→A, C→B, C→D, C→E, C→F, C→G

A→E, A→F is redundant

STEP 3: No FD have redundant attributes on LHS

A→B, A→C, A→D, A→G

G→E, G→F

3NF:

A→BCDG   G→EF

R_1 (ABCDG) = R_1 (customer_id, username, email,password,phone_num)

R_2 (GEF) = R_2(phone_num,full_name,address)

∴ The relation is in 3NF

3. ORDER (order_id, date, status, customer_id)

Keys: order_id

Primary Key: order_id

FDs: order_id → date, status, customer_id

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

∴The relation is in 3NF

4. ORDER_ITEM (sequence_num, order_id , product_unit_price, quantity, status, order_price, product_id, shipment_id)

Keys: {sequence_num, order_id}

Primary Key: {sequence_num, order_id}

FDs:

sequence_num, order_id →product_unit_price, quantity, status, order_price,
   product_id, shipment_id

product_id → product_unit_price

product_unit_price, quantity → order_price

conclusion

product_id, { product_unit_price, quantity}is not a superkey of the relation

product_unit_price and order_price are not contained in a key

∴The relation is **not** in 3NF

3NF Procedures:

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

= ORDER_ITEM(A,B,C,D,E,F,G,H)

KEYS: AB

FDS: AB→CDEFGH, C →E, EF→H

STEP 1(Minimal Basis for R):

STEP 1.1(For all FD, RHS must have only one attribue):

AB→C, AB→D ,AB→E ,AB→F, AB→G, AB→H ,C→E ,EF→H

STEP 1.2(Remove redundant FDs):

we remove AB→E

$\{AB\}^+$={ABCDEFGH}

AB→C,   C→E,   AB→E

∴ AB → E is redundant

we remove AB→H

$\{AB\}^+$={ABCDEFGH}

AB→C,   C→E,   AB→F ,   EF→H

∴ AB → H is redundant

STEP 1.3(For all FDs, LHS must have no redundant attribues):

AB→C, AB→D ,AB→F, AB→G, AB→H ,C→E ,EF→H

STEP 2(Combine all FDs with common LHS):

AB→CDFG   C→E   EF→H

STEP 3(Create table for each FD):

R_1 (ABCDFG) = R_1 ((sequence_num, order_id) , product_id, shipment_id, quantity, status)

R_2(CE) = R_2(product_id,product_unit_price)

R_3(EFH) = R_3(product_unit_price, quantity,order_price)

All the attributes are functionally dependent on solely their Primary Keys

∴ The relation is in 3NF

5. PRODUCT_TYPE (product_type_id, description, parent_product_type_id)

   Keys: product_type_id

   Primary Key: product_type_id

   FDs: product_type_id → description, parent_product_type_id

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

   ∴The relation is in 3NF

6. 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 → shop_id,product_type_id

   Only trival FD exists in the relation

   ∴ The relation is in 3NF

7. SHIPMENT (shipment_id, tracking_num, date, invoice_number)

   Keys: shipment_id, tracking_num

   Primary Key: shipment_id

   FDs: shipment_id → tracking_num, date,invoice_number

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

   ∴The relation is in 3NF

8. INVOICE(invoice_number,date,status,order_id)

   Keys: invoice_number

   Primary Key: invoice_number

   FDs: invoice_number → date,status,order_id

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

   ∴The relation is in 3NF

9. PAYMENT (payment_id, amount, card_num,invoice_number)

Keys: payment_id

Primary Key: payment_id

FDs: payment_id → amount,card_num,invoice_number

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

∴The relation is in 3NF

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

Keys: product_id

Primary Key: product_id

FDs: product_id → name,colour,price,size,description,shop_id,product_type_id

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

∴The relation is in 3NF

11. PRODUCT_PHOTO(photo_sequence,product_id,pic)

Keys: {photo_sequence, product_id}

Primary Key: {photo_sequence,product_id}

FDs: photo_sequence,product_id → pic

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

∴The relation is in 3NF

12. SHOP (shop_id, shop_name)

Keys: shop_id

Primary Key: shop_id

FDs: shop_id→ shop_name

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

∴The relation is in 3NF