ASSIGNMENT 2

Normalization

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1) Q.

Order (Order #, order_date, customer #, total_amount)

Order_Item (order #, Item #, Quantity_ordered, price_each, total_price, discount %)

R1 { order #, Order_date)

R12 { customer #, total_amount)

R11 { quantity_ordered, price_each, total_price }

R21 { order #, Item #, discount %}

R31 { Item #, discount %}

R32 { order #}

2) a. Rx (Doctor #, patient #, date, diagnosis, Treatment code, charge).

The relation is not in BCNF.

{Doctor #, patient #, date} → {diagnosis, treatment-code, charges}

{treatment_code} → {charges}

R {Doctor #, patient #, Date, diagnosis, treatment_code}

R1 {treatment_code, charge}

{DOctor #, patient #, Date} → {diagnosis, Treatment code, charge}

{treatment_code} → {charge}

Both violate BCNF.

∴

Rx is decompesed into R2 & R1.

3) Q.

R (A, B, C, D, E, F, G, H, I, J)

functional dependencies { AB → C, A → DE, B → F, F → GH, D → IJ }

A minimal set of attributes whose closure includes all the attributes in R is a key.

Since the closure of {A, B} + = R

One key of R is {A, B}

Normalization of R into 2NF and 3NF.

1) Identify partial dependencies that violate 2NF.

{A} & {B} alone

{A}+ = { A, D, E, I, J } Hence {A} → {D, E, I, J}

{A} is a trivial dependency

{B}+ = { B, F, G, H } Hence {B} → {F, G, H}

{B} is a trivial dependency.

To normal into 2NF, we remove the attributes that are FD on part of the key -(A or B) from R and place them in seperate relations R1 and R2

R1 = {A, D, E, I, J}

R2 = {B, F, G, H}

R3 = {A, B, C}

The new keys for R_1, R_2, R_3

Transive dependencies in R_1, R_2 R_3.

The relation R_1 has the transitive depencency $\{A\} \rightarrow \{D\} \rightarrow \{i,j\}$ so, we remove the transitively dependant attributes $\{i,j\}$ from R_1. into a relation R_{11} and copy the attributes D. they are depadent on into R_{11}.

Remaining attributes are kept in a relation R_{12}.

Hence R_1 is decompose into R_{11} and R_{12}.

$R_{11} = \{D, I, J\}$

$R_{12} = \{A, D, E\}$

relation R_2 is similarly decomposed into R_{21} and R_{22} based on the transitive. dependency $\{B\} \rightarrow \{F\} \rightarrow \{G, H\}$

$R_2 = \{F, G, H\}$

$R_2 = \{B, F\}$

The final set of relations in 3NF are $\{R_{11}, R_{12}, R_{21}, R_{22}, R_3\}$.

11) Functional dependencies

$\{AB \to C,\ BD \to EF,\ AD \to GH,\ A \to I,\ H \to J\}$

$\{A\}+ \to \{A, I\}$.

$\{B\}+ \to \{B\}$

$\{C\}+ \to \{C\}$

$\{D\}+ \to \{D\}$

$\{E\}+ \to \{E\}$

$\{F\}+ \to \{F\}$

$\{G\}+ \to \{G\}$

$\{H\}+ \to \{H, J\}$

$\{I\}+ \to \{I\}$

$\{J\}+ \to \{J\}$

none of the single attributes are key.

closure : ~~attributes of~~ pairs of attributes that possible keys.

$\{A,B\}+ \to \{A, B, C, I\}$

$\{B,D\}+ \to \{B, D, E, F\}$

$\{A,D\}+ \to \{A, D, G, H, I, J\}$

none of these attributes are key but union of the these closure includes.

$\{A, B, D\}+ \to \{A, B, C, D, E, F, G, H, I\}$.

Hence $\{A, B, D\}$ is a key.

We have $R = \{A, B, C, D, E, F, G, H, I\}$

First level functional dependencies on key are.

$\{A, B\} \rightarrow \{C, I\}$

$\{B, D\} \rightarrow \{E, F\}$

$\{A, D\}^+ \rightarrow \{G, H, I, J\}$

Hence R can be decomposed into R_1, R_2, R_3, R_4.

$R_1 = \{A, B, C, I\}$ $\quad R_3 = \{A, D, G, H, I, J\}$

$R_2 = \{B, D, E, F\}$ $\quad R_4 = \{A, B, D\}$

Additionaly partial dependencies exist in R_1 and R_3. because $\{A\} \rightarrow \{I\}$

Hence remove $\{I\}$ into R_5.

resulting 2NF decomposition is.

$\{R_1 = \{A, B, C\}$ $R_2 = \{B, D, E, F\}$ $R_3 = \{A, D, G, H, J\}$ $R_4 = \{A, B, D\}$ $R_5 = \{A, I\}$

Transitive dependencies

Only R_3 has transitive dependencies $\{A, D\} \rightarrow \{H\} \rightarrow \{J\}$

So decomposes into R_{31}, and R_{32} as follows.

$R_{31} = \{H, J\}$ $\quad R_{32} = \{A, D, G, H\}$

The final set of 3NF relation is $\{R_1, R_2, R_{31}, R_{32}, R_4, R_5\}$

4Q).

a) manufacturer, serial_number → model, batch, capacity, retailer.

b) model → manufacturer.

c) manufacture, batch → ~~new~~ model.

d) model → capacity.

To Decompose DISK_drive into 3NF.

R { serial_number, manufacturer, model, batch, capacity, Retailer}

R1 { serial_number, batch, capacity, Retailer}

R2 { manufacturer, model}

~~Now~~ No trivial relation / ~~dependencies~~. dependencies.