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Key And Key Attributes Set, Non-Key Attributes Set with Translation of Block Schemes

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Abstract: The report proposes and demonstrates some properties of key and the sets of primitive, non primitive attributes with the translation of block scheme. The relationship between the key of block and the key of slice through the translation, the results of key through the translation... From the properties have been demonstrated, which more clearly shows the key structure of the block scheme in the particular case of data model for block form.

Keywords: key, non-key, block schemes, attributes

I. DATABASE MODEL OF BLOCK FORM

A. *The block, block scheme [1]:*

Definition 1.1:

Let $R = (id; A_1, A_2,..., A_n)$ be a finite tulle of elements, in which id is a nonempty finite index set, A_i (i=1..n) is called attributes. Corresponding to each attribute Ai (i=1..n) there is a set $dom(A_i)$ called the domain of A_i. The block r over R, denoted r(R) consists of a finite number of elements where each element is a family of mappings from the index set id to the value domain of the attribute A_i (i=1..n).

$t \in r(R) \Leftrightarrow t = \{ t^i : id \to dom(A_i)\}_{i=1..n}$.

The block is denoted r(R) or $r(id; A_1, A_2,..., A_n)$, sometimes without fear of confusion we simply denoted r.

Definition 1.2:

Let $R = (id; A_1, A_2,..., A_n)$, r(R) is a block over R. For each $x \in id$ we denoted $r(R_x)$ is a block with $R_x = (\{x\}; A_1, A_2,..., A_n)$ such that:

$t_x \in r(R_x) \Leftrightarrow t_x = \{t^i_x = t^i\}_{i=1..n}$, $t \in r(R)$, $t = \{ t^i : id \to dom(A_i)\}_{i=1..n}$.

where $t^a_x(x) = t^i(x)$, i =1..n.

Then $r(R_x)$ is called a slice of block on the block r(R) at point x.

B. *Functional Dependencies [1] :*

Here, for simplicity we use the notation:

$x^{(i)} = (x; A_i)$; $id^{(i)} = \{x^{(i)} \mid x \in id\}$.

$x^{(i)}$ ($x \in id$, i = 1..n) is called a index attribute of block scheme $R = (id; A_1,A_2,...,A_n)$.

Definition 1.3:

Let $R = (id; A_1,A_2,...,A_n)$, r(R) is a block over R, $X \to Y$ is a notation of functional dependency. A block r satisfies $X \to Y$ if for any $t_1, t_2 \in R$ such that $t_1(X) = t_2(X)$ then $t_1(Y) = t_2(Y)$.

Definition 1.4:

Let block scheme $\alpha = (R,F)$, $R = (id; A_1, A_2,..., A_n)$, F is the set of functional dependencies over R.

Then, the closure of F denoted F^+ is defined as follows:

$$F^+ = \{ X \to Y \mid F \Rightarrow X \to Y \} .$$

If $X = \{x^{(m)}\} \subseteq id^{(m)}$, $Y = \{y^{(k)}\} \subseteq id^{(k)}$ then we denoted functional dependency $X \to Y$ is simply $x^{(m)} \to y^{(k)}$.

The block satisfies $x^{(m)} \to y^{(k)}$ if for any $t_1, t_2 \in r$ such that $t_1(x^{(m)}) = t_2(x^{(m)})$ then $t_1(y^{(k)}) = t_2(y^{(k)})$,

where: $t_1(x^{(m)}) = t_1(x; A_m)$, $t_2(x^{(m)}) = t_2(x; A_m)$,

$t_1(y^{(k)}) = t_1(y; A_k)$, $t_2(y^{(k)}) = t_2(y; A_k)$.

C. *Closure of the Index Set Attributes [2] :*

Definition 1.5:

Let block scheme $\alpha = (R,F)$, $R=(id; A_1, A_2,..., A_n)$, F is a set of functional dependencies over R.

For each $X \subseteq \bigcup_{i=1}^{n} id^{(i)}$, we define closure of X for F denoted X^+ as follows:

$$X^+ = \{x^{(i)} , x \in id, i = 1..n \mid X \to x^{(i)} \in F^+ \} .$$

Let $R=(id; A_1, A_2,..., A_n)$, we denoted the sets of functional dependecies over R:

$$F_h \subseteq \{ X \to Y \mid X = \bigcup_{i \in A} x^{(i)} , Y = \bigcup_{j \in B} x^{(j)} ,$$
$$A, B \subseteq \{1,2,...,n\} \text{ và } x \in id \} ,$$

$$F_{hx} = F_h \cap \bigcup_{i=1}^{n} x^{(i)} = \{ X \to Y \in F_h \mid X, Y \subseteq \bigcup_{i=1}^{n} x^{(i)} \}.$$

D. *Key of Block Scheme $\alpha = (R,F)$ [2] :*

Definition 1.6 :

Let block scheme $\alpha = (R,F)$, $R = (id; A_1, A_2,..., A_n)$, F is a set of functional dependencies over R, $K \subseteq \bigcup_{i=1}^{n} id^{(i)}$.

K called a key of block schema α if it satisfies two conditions:

a) $K \rightarrow x^{(i)} \in F^+$, $\forall x \in id$, i = 1..n.

b) $\forall K' \subset K$ then K' has no properties a).

If K is a key and $K \subseteq K''$ then K'' called a super key of the block scheme R for F.

E. Translation of Block Schemes [3]:

Definition 1.7:

Let block schemes α = (R,F), β = (S,G), $X \subseteq \bigcup_{i=1}^{n} id^{(i)}$,

$X = \{x^{(i)}, x \in id, i \in A\}$, $A \subseteq \{1,2, ..., n\}$. We have that, scheme β is obtained from the scheme α by translation follow the set of attributes X, if after removing the attributes from X in the scheme α then we are obtained scheme β. Then we denoted: $\beta = \alpha \setminus X$.

Actions remove the X from scheme α to scheme β as follows:

a. Calculate S = R \X, R = (id; A_1, A_2,..., A_n), here we remove the attributes A_i ($i \in A$) in R, complexity of this procedure is O(nk), where k is the number of elements in A.
b. For each functional dependencies from M->N in F, with M, N $\subseteq \bigcup_{i=1}^{n} id^{(i)}$ we have to create a new functional dependency M\X -> N\X in G. This procedure is denoted by G = F \ X and has the complexity O (mnk) with m is the number of functional dependencies in F.

We see that, the complexity of translation $\beta = \alpha \setminus X$ = (R\X, F\X) is O(mnk), so it is linear in the length of the input data.

After performing the procedure G = F\X then:

+ If G contains trivial functional dependencies (as X->Y, $X \supseteq Y$) then we remove them from G.

+ If G contains same functional dependencies then we exclude duplicate of this functional dependencies (G contains no overlap).

We have the following comments:

Reviews 1:

Let block schemes α = (R,F), β = (S,G), $X \subseteq \bigcup_{i=1}^{n} id^{(i)}$,

$X = \{x^{(i)}, x \in id, i \in A\}$, $A \subseteq \{1,2, ..., n\}$. Scheme β received from scheme α by the translation follow the set of attributes X: $\beta = \alpha \setminus X$.

Then, if id={x} then the block scheme α reduces to the relational schema and the translation follow the set of attributes X in this case becomes the translation follow the set of attributes X in the relational data model.

Reviews 2:

Let block schemes α = (R, F_h), β = (S, G_h), $X \subseteq \bigcup_{i=1}^{n} id^{(i)}$, $X = \{x^{(i)}, x \in id, i \in A\}$, $A \subseteq \{1,2, ..., n\}$. Then, if scheme β received from the scheme α by the translation follow the set of attributes X, mean $\beta = \alpha \setminus X$ then:

$$S = R \setminus X,\ G_h = F_h \setminus X = \bigcup_{x \in id} F_{hx} \setminus X.$$

Since we have: $G_{hx} = F_{hx} \setminus (X \cap \bigcup_{i=1}^{n} x^{(i)})$, $\forall x \in id$.

Thus, the translation of block scheme in this case was transferred to the translation of slice schemes, for each the slice scheme then this translation is the translation of relational scheme in the relational data model.

II. RESULTS

A. Performance of key by Translation:

Let block scheme α = (R,F_h), R = (id; A_1, A_2, ... , A_n) and *X*, U_o, U_K, U_I are the index sets of attributes $\subseteq \bigcup_{i=1}^{n} id^{(i)}$, for block scheme α we denoted:

- U_o is the set of all non key attributes.
- U_K is the set of all key attributes.
- U_I is the set of all attributes, which is in every key.

Let block schemes α*=(R,*F_h*), R= (id;* A_1*,* A_2*, ... ,* A_n *);* β *= (S,G),* $\beta = \alpha \setminus X$*. Then we denoted:*

- $\alpha_x = (R_x, F_{hx})$ *is a slice scheme of* $\alpha = (R, F_h)$ *at point x,*
- $\beta_x = (S_x, G_x)$ *is a slice scheme of* β *=(S,G) at poimt x.*

Proposition 2.1 (Necessary and Sufficient Condition) :

Let block scheme $\alpha = (R, F_h)$*, R = (id;* A_1*,* A_2*, ... ,* A_n *);* *X*, $K \subseteq \bigcup_{i=1}^{n} id^{(i)}$, $X = \{x^{(i)}, x \in id, i \in A\}$, $K = \{x^{(i)}, x \in id, i \in B\}$; *A, B* $\subseteq \{1,2, ..., n\}$, $X \cap K = \varnothing$, $X \subseteq U_I$, $\beta = (S,G)$, $\beta = \alpha \setminus X$. *Then:*

a) K is a key of β *if only if XK is a key of* α*.*

b) K is a key of β *if only if* $X_x K_x$ *is a key of* $\alpha_x = (R_x, F_{hx})$, $X_x = \{x^{(i)}, i \in A\}$, $K_x = \{x^{(i)}, i \in B\}$, $x \in id$.

Proof

a =>) Suppose K is the key of β => K is the super key of β => *X*K, $X \cap K = \varnothing$ is the super key of α => exists $K' \subseteq K$, $X \cap K' = \varnothing$ that XK' is the key of α *(because* $X \subseteq U_I$). According to the properties of key stated in [7] => XK' \ X = K' is the key of β, vì $K' \subseteq K$ => K' = K. Then XK is the key of α.

(a) <=) Conversely, suppose XK is a key of α, *a*ccording to the properties of key stated in [7] => XK\ X = K is a key of β.

(b) =>) Suppose K is a key of β => in the question a) above we have XK is the key of α , According to the necessary and sufficient conditions of key in the block scheme [4] => $XK \cap \bigcup_{i=1}^{n} x^{(i)} = X_x K_x$ is a key of $\alpha_x = (R_x, F_{hx})$.

b<=) Suppose $X_x K_x$ is a key of $\alpha_x = (R_x, F_{hx})$, $X_x = \{x^{(i)}, i \in A\}$, $K_x = \{x^{(i)}, i \in B\}$, $x \in id$ => $\bigcup_{x \in id} X_x K_x$ = XK is a key of α (according to the properties of key in the block scheme [4]) . On the other hand from XK is the key of α, so the results of question a) => K is a key of β.

Conséquences :

Let block scheme $\alpha = (R, F_h)$, $R = (id; A_1, A_2, \dots, A_n)$; X, Y, K $\subseteq \bigcup_{i=1}^{n} id^{(i)}$, X ={$x^{(i)}$, x$\in$ id, i $\in$ A}, Y ={$x^{(i)}$, x$\in$ id, i $\in$ B}, K ={$x^{(i)}$, x$\in$ id, i $\in$ C}; A, B, C $\subseteq$ {1,2, ..., n}, Y $\subseteq U_I$, X $\subseteq U_o$, $\beta = (S,G)$, $\beta = \alpha \setminus XY$. Then:

a) K is a key of β if and only if YK is a key of α.
b) K is a key of β if and only if $Y_x K_x$ is a key of $\alpha_x=(R_x,F_{hx})$, Y_x= {$x^{(i)}$, i$\in$B}, K_x= {$x^{(i)}$, i$\in$C}, x$\in$ id.

Proof

a) We denoted $\gamma = \alpha \setminus X$, then $\beta = \alpha \setminus XY = (\alpha \setminus X) \setminus Y = \gamma \setminus Y$ (where $X \cap Y = \varnothing$ vì $Y \subseteq U_I$, $X \subseteq U_o$) . Since, because $Y \subseteq U_I$ and apply proposition 2.1 we have: *K is a key of β if and only if YK is a key of γ.*

On the other hand, because $X \subseteq U_o$ and apply properties of key when translation the block scheme in [7], we have: *YK is a key of* γ if and only if *YK is a key of α.* Thus: *K is a key of β if and only if YK is a key of α.*

b) Suppose *K is a key of β*, according to a) we have:

K is a key of β if and only if YK is a key of α. (i)

Since apply properties of key for the block scheme in [4] inferred:

YK is a key of α if and only if $Y_x K_x$ is a key of $\alpha_x=(R_x,F_{hx})$, Y_x= {$x^{(i)}$, i$\in$B}, K_x= {$x^{(i)}$, i$\in$C}, x$\in$ id. *(ii)*

From (1) and (2) we have:

K is a key of β if and only if $Y_x K_x$ is a key of $\alpha_x=(R_x,F_{hx})$, Y_x= {$x^{(i)}$, i$\in$B}, K_x= {$x^{(i)}$, i$\in$C}, x$\in$ id.

B. The set of Primitive and Non Primitive Attributes:

Let block scheme $\mu = (R, F)$, where we denoted:

- LS(F) is the set of attributes appearing in the left side and RS(F) is the set of attributes appearing in the right side of functional dependencies in F.
- Attr(F) = LS(F) $\cup$ RS(F)

Then we have: Attr(F) $\subseteq \bigcup_{i=1}^{n} id^{(i)}$.

Proposition 2.2:

Let block scheme $\alpha = (R, F_h)$, $R = (id; A_1, A_2, \dots, A_n)$; X, M $\subseteq \bigcup_{i=1}^{n} id^{(i)}$, X $\subseteq$ M, X ={$x^{(i)}$, x$\in$ id, i $\in$ A}, M = {$x^{(i)}$, x$\in$ id, i $\in$ B}; A, B $\subseteq$ {1,2, ..., n}. Then, following conditions are equivalent:

a) $X_x^{+} \cap M_x = X_x$, x$\in$ id
b) $X_x^{+} \cap (M_x \setminus X_x) = \varnothing$, x$\in$ id
c) $M_x \setminus X_x^{+} = M_x \setminus X_x$, x$\in$ id

where: X_x = {$x^{(i)}$, i $\in$ A}, M_x = {$x^{(i)}$, i $\in$ B}.

Proof

a) => b): We have $X_x^{+} \cap M_x = X_x$, x$\in$ id, we need to prove: $X_x^{+} \cap (M_x \setminus X_x) = \varnothing$, x$\in$ id.

Indeed, suppose the opposite exist P $\in X_x^{+} \cap (M_x \setminus X_x)$ => P $\in X_x^{+}$ and P $\in M_x \setminus X_x$ => P $\in X_x^{+}$ and P $\in M_x$ và P$\notin X_x$ => P $\in X_x^{+} \cap M_x = X_x$ và P$\notin X_x$ => contradiction. Hence $X_x^{+} \cap (M_x \setminus X_x) = \varnothing$, x$\in$ id.

b) => c): We have $X_x^{+} \cap (M_x \setminus X_x) = \varnothing$, x$\in$ id, we need to prove: $M_x \setminus X_x^{+} = M_x \setminus X_x$, x$\in$ id.

Indeed, by $X_x \subseteq X_x^{+}$ => $M_x \setminus X_x^{+} \subseteq M_x \setminus X_x$. (1)

Suppose that P $\in M_x \setminus X_x$ => P $\in M_x$ and P$\notin X_x$, so P $\notin X_x^{+}$ because if P $\in X_x^{+}$ then we deduce P $\in X_x^{+} \cap (M_x \setminus X_x) = \varnothing$ (under the assumption) => contradiction. So P $\in M_x \setminus X_x^{+}$ => $M_x \setminus X_x \subseteq M_x \setminus X_x^{+}$ (2).

From (1) and (2) we have: $M_x \setminus X_x^{+} = M_x \setminus X_x$, x$\in$ id.

c) => a): We have $M_x \setminus X_x^{+} = M_x \setminus X_x$, x$\in$ id, we need to prove: $X_x^{+} \cap M_x = X_x$, x$\in$ id.

Indeed, under the assumption we have X $\subseteq$ M => $X_x \subseteq M_x$, on the other hand, under the nature of closure then: $X_x \subseteq X_x^{+}$ => $X_x \subseteq X_x^{+} \cap M_x$. (1)

Conversely, suppose P $\in X_x^{+} \cap M_x$ => P $\in X_x^{+}$ and P $\in M_x$ => P$\notin M_x \setminus X_x^{+}$

If P $\notin X_x$ then P $\in M_x \setminus X_x = M_x \setminus X_x^{+}$, so P $\in M_x$ and P $\notin X_x^{+}$ => conflict => P $\in X_x$. So $X_x^{+} \cap M_x \subseteq X_x$. (2)

From (1) and (2) we inferred $X_x^{+} \cap M_x = X_x$.

Proposition 2.3:

Let block scheme $\alpha = (R, F_h)$, $R = (id; A_1, A_2, \dots, A_n)$; X, M $\subseteq \bigcup_{i=1}^{n} id^{(i)}$, X ={$x^{(i)}$, x$\in$ id, i $\in$ A}, M = {$x^{(i)}$, x$\in$ id, i $\in$ B}; A, B $\subseteq$ {1,2, ..., n}. Then, following conditions are equivalent:

a) $X^{+} \cap M = X$
b) $X^{+} \cap (M \setminus X) = \varnothing$
c) $M \setminus X^{+} = M \setminus X$

Proof

Using the necessary and sufficient conditions for the closure of the index attribute set of block scheme in [4] we have:

a) $X_x^{+} \cap M_x = X_x$, x$\in$ id <=> $X^{+} \cap M = X$
b) $X_x^{+} \cap (M_x \setminus X_x) = \varnothing$, x$\in$ id <=> $X^{+} \cap (M \setminus X) = \varnothing$
c) $M_x \setminus X_x^{+} = M_x \setminus X_x$, x$\in$ id <=> $M \setminus X^{+} = M \setminus X$

From these results, we deduce the equivalent of three equations in the statement of proposition 2.3.

Proposition 2.4:

Let block scheme $\alpha = (R, F_h)$, $R = (id; A_1, A_2, \dots, A_n)$; X $\subseteq \bigcup_{i=1}^{n} id^{(i)}$, X ={$x^{(i)}$, x$\in$ id, i $\in$ A}; A $\subseteq$ {1,2, ..., n}, F_h is a sufficient set of functional dependencies over R . Then we have:

a) $\bigcup_{i=1}^{n} x^{(i)} \setminus Attr(F_{hx}) \subseteq U_{Ix}$, x$\in$ id
b) If $X_x \subseteq U_{Ix}$ then $X_x^{+} \cap U_{Kx} = X_x$, x$\in$ id

Proof

a) We denoted $M_x = RS(F_{hx}) \setminus LS(F_{hx})$, then we have: $U_{Ix} = \bigcup_{i=1}^{n} x^{(i)} \setminus M_x$, moreover we have:

$$M_x \subseteq Attr(F_{hx}) \Rightarrow \bigcup_{i=1}^{n} x^{(i)} \setminus Attr(F_{hx})$$

$$\subseteq \bigcup_{i=1}^{n} x^{(i)} \setminus M_x = U_{Ix}.$$

b) Assume that $\{K_1, K_2, \ldots, K_t\}$ is the set of keys on the slice scheme $\alpha_x = (R_x, F_{hx})$, $X_x \subseteq U_{Ix}$ then the nature of keys we have:
If $X_x \subseteq U_{Ix}$ then $X_x \subseteq U_{Ix} \subseteq K_{ix} \Rightarrow X_x^{+} \cap K_{ix} = X_x$, i=1..t .
Vậy: $X_x^{+} \cap U_K = X_x$, $x \in id$.

Consequence :

Let block scheme $\alpha = (R, F_h)$, $R = (id; A_1, A_2, \ldots, A_n)$; $X \subseteq \bigcup_{i=1}^{n} id^{(i)}$, $X = \{x^{(i)}, x \in id, i \in A\}$; $A \subseteq \{1,2, \ldots, n\}$, F_h is a sufficient set of functional dependencies over R . Then we have:

a) $\bigcup_{i=1}^{n} id^{(i)} \setminus Attr(F_h) \subseteq U_I$

b) If $X \subseteq U_I$ then $X^{+} \cap U_K = X$

Proof

a) From a) in the proposition 2.4 we have:
$\bigcup_{i=1}^{n} x^{(i)} \setminus Attr(F_{hx} \subseteq U_{Ix}$, $x \in id$

Thus, when we take the union of the left side and union of the right side respectively then the nature of implies not change, so:

$$\bigcup_{i=1}^{n} id^{(i)} \setminus Attr(F_h) \subseteq U_I$$

b) Prove by the method as in question a).

Proposition 2.5:

Let block scheme $\alpha = (R, F_h)$, $R = (id; A_1, A_2, \ldots, A_n)$; $X, Y \subseteq \bigcup_{i=1}^{n} id^{(i)}$, $X = \{x^{(i)}, x \in id, i \in A\}$, $Y = \{x^{(i)}, x \in id, i \in B\}$; $A, B \subseteq \{1,2, \ldots, n\}$, F_h is a sufficient set of functional dependencies over R. Then:

If $x^{(i)} \notin LS(F_{hx})$ and $F_{hx} \Rightarrow X_x \to Y_x$ then $F_{hx} \Rightarrow X_x \setminus x^{(i)} \to Y_x \setminus x^{(i)}$, i=1..n,
wherei $X_x = \{x^{(i)}, i \in A\}$, $Y_x = \{x^{(i)}, i \in B\}$.
Proof

We consider the slice scheme $\alpha_x = (R_x, F_{hx})$, from assuming $F_{hx} \Rightarrow X_x \to Y_x$ inferred $Y_x \subseteq X_x^{+}$. Based on the algorithm search closure of X_x then existing a range of functional dependencies $L_1 \to R_1$, $L_2 \to R_2$, … ,$L_k \to R_k$ such that:

$L_1 \subseteq X$, $L_2 \subseteq XR_1$, $L_3 \subseteq XR_1R_2$, …, $L_k \subseteq XR_1R_2 \ldots R_{k-1}$,

$Y \subseteq XR_1R_2 \ldots R_{k-1} R_k = X^{+}$. (1)

Because $x^{(i)} \notin LS(F_{hx}) \Rightarrow x^{(i)}$ does not appear in the left side of F so we have:

$L_1 \subseteq X \setminus x^{(i)}$, $L_2 \subseteq (X \setminus x^{(i)}) R_1$, $L_3 \subseteq (X \setminus x^{(i)}) R_1R_2$, …,
$L_k \subseteq (X \setminus x^{(i)}) R_1R_2 \ldots R_{k-1}$, $Y \subseteq (X \setminus x^{(i)}) R_1R_2 \ldots R_{k-1} R_k = (X \setminus x^{(i)})^{+}$. (2)
From (1) and (2) we have:

$$(X \setminus x^{(i)})^{+} = (X \setminus x^{(i)}) R_1R_2 \ldots R_{k-1} R_k = XR_1R_2 \ldots R_{k-1} R_k \setminus x^{(i)} \supseteq Y \setminus x^{(i)}$$

So: $F_{hx} \Rightarrow X \setminus x^{(i)} \to Y \setminus x^{(i)}$.

Conséquence ;

Let block scheme $\alpha = (R, F_h)$, $R = (id; A_1, A_2, \ldots, A_n)$; $X, Y \subseteq \bigcup_{i=1}^{n} x^{(i)}$. Then, if $x^{(i)} \notin LS(F_h)$ and $F_h \Rightarrow X \to Y$ then $F_h \Rightarrow X \setminus x^{(i)} \to Y \setminus x^{(i)}$, i=1..n, $x \in id$.

Proposition 2.6:

Let block scheme $\alpha = (R, F_h)$, $R = (id; A_1, A_2, \ldots, A_n)$; $X \subseteq \bigcup_{i=1}^{n} id^{(i)}$, $X = \{x^{(i)}, x \in id, i \in A\}$; $A \subseteq \{1,2, \ldots, n\}$, F_h is a sufficient set of functional dependencies over R. Then:

a) $U_{ox}^{+} = U_{ox}$, $x \in id$

b) $X_x \subseteq U_{ox} \Leftrightarrow U_{ox} \to X_x \Leftrightarrow U_{ox} \to X_x^{+} \Leftrightarrow X_x^{+} \subseteq U_{ox}$, $x \in id$

c) If $\varnothing \to X_x$ then $X_x^{+} \subseteq U_{ox}$, $x \in id$

d) $RS(F_h) \setminus LS(F_h) \subseteq U_{ox}$, $x \in id$

where $X_x = \{x^{(i)}, i \in A\}$, $U_{ox} = \{x^{(i)} \mid x^{(i)} \in U_o\}$, $x \in id$.
Proof

a) Follow the definition of closure we have: $U_{ox} \subseteq U_{ox}^{+}$, so to prove $U_{ox}^{+} = U_{ox}$ we need to prove $U_{ox}^{+} \subseteq U_{ox}$.

Indeed, assume that P is a key attribute and $P \in U_{ox}^{+}$, K_x is the key contained P in $\alpha_x = (R_x, F_{hx})$. Then: $U_{ox} \to P$, put $Y = K_x \setminus P \Rightarrow YP = K_x$.

We have: $YU_o \to YP$, where $YP = K_x$ is a key $\Rightarrow YU_o$ is a superkey in α_x , according to the nature of the superkey then: $YU_o \setminus U_o = Y$ is a superkey. This contradicts with the assumption Y is actually part of the key K_x. So we have: $U_{ox}^{+} \subseteq U_{ox}$.

b) To demonstrate the sequence above, we will prove the circle diagramn:

Indeed, from $X_x \subseteq U_{ox} \Rightarrow U_{ox} \to X_x \Rightarrow U_{ox} \to X_x^{+} \Rightarrow X_x^{+} \subseteq U_{ox}^{+}$, according to a) we have: $U_{ox}^{+} = U_{ox}$. Therefore: $X_x^{+} \subseteq U_{ox} \Rightarrow X_x \subseteq U_{ox}$.

c) We have: $U_{ox} \to \varnothing$, which $\varnothing \to X_x$ inferred: $U_{ox} \to X_x$. According to b) has been proved, then $X_x^{+} \subseteq U_{ox}$.

d) We prove: $RS(F_h) \setminus LS(F_h) \subseteq U_{ox}$, $x \in id$, indeed:

Assume that $F_h = \{L_1 \to R_1, L_2 \to R_2, \ldots, L_k \to R_k\}$ then by the nature of the additive functional dependencies, we have: $L_1L_2 \ldots L_k \to R_1R_2 \ldots R_k$ that is: $LS(F) \to RS(F)$. To prove $RS(F_h) \setminus LS(F_h) \subseteq U_{ox}$, we prove by feedback method.

Assume that conversely, we have key attribute $P \in RS(F) \setminus LS(F)$ and K_x is the key contains P. Then: $K_x \to U_x$, $P \in RS(F)$, $P \notin LS(F) \Rightarrow K_x \setminus P \to U_x \setminus P$. Because $P \notin LS(F) \Rightarrow LS(F) \subseteq U_x \setminus P \Rightarrow U_x \setminus P \to LS(F)$,where $LS(F) \to RS(F)$, $RS(F) \to P$. Then $K_x \setminus P \to P \Rightarrow$ contradict with the assumption K_x is the key. Then we have:
$RS(F_h) \setminus LS(F_h) \subseteq U_{ox}$, $x \in id$.

III. CONCLUSION

The results for the keys, the primitive and non primitive attribute sets with the tranlation of block scheme in the database model of block form studied above are only the initial results. In the case of blocks degenerate into relations then these results to coincide with the results given by many authors for relations in the relational data model. Some results are considered in the particular case of the F set of functional dependencies in the block scheme as F_h, set of functional dependecies full... On the basis of these results we can deploy to process normalization and vaguely normalization using the translation on the block scheme... contribute to more complete the design theory of database model of block form.

IV. REFERENCES

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