CS2102 Tutorial 8: FD

Wk 11, Sem 2, 2021/22

Questions to be discussed: 1, 2, 3, 4

1. Consider the following relation instance r of the relational schema $R(A, B, C, D)$.

R

A	B	C	D
8	6	1	7
0	4	1	9
8	6	1	7
8	5	2	7

List all the functional dependencies of the form $\alpha \rightarrow \beta$ where $\alpha \subseteq R$[1] and $\beta \in R$ that *definitely* do not hold on R. In fact, this can be symbolised as $\alpha \nrightarrow \beta$.

2. Consider the relational schema R and let $a, b, c, d \subseteq R$. Use only Armstrong's axioms to prove the soundness of the following two inference rules:

   (a) *Pseudo Transitivity*: If $a \rightarrow b$ and $bc \rightarrow d$, then $ac \rightarrow d$.

   (b) *Composition Rule*: If $a \rightarrow b$ and $c \rightarrow d$, then $ac \rightarrow bd$.

   You can try writing the proofs move systematically at https://www.comp.nus.edu.sg/~adi-yoga/CS2102/FD/.

3. Consider $R(A, B, C, D, E, G)$[2] with set of functional dependencies $F = \{ABC \rightarrow E, BD \rightarrow A, CG \rightarrow B\}$.

   (a) Use Armstrong's axioms to show that F implies $CDG \rightarrow E$.

   (b) Compute $\{CDG\}^+$.

   (c) Find all the keys of R.

   You can try writing the proofs move systematically at https://www.comp.nus.edu.sg/~adi-yoga/CS2102/FD/.

4. Consider $R(A, B, C, D, E)$ with set of functional dependencies $F = \{AB \rightarrow CDE, AC \rightarrow BDE, B \rightarrow C, C \rightarrow B, C \rightarrow D, B \rightarrow E\}$.

   Find all the keys of R.

[1] Basically, α is a *set of attributes* and β is a *single attribute*.

[2] Why G and not F? We reserve F for the set of functional dependencies.