CSC343 Prep 9

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1. Suppose we have a relation on attributes $A, B, C, D, E,$ and F , and these functional dependencies hold: $S = \{B \rightarrow DE, BF \rightarrow C, CF \rightarrow B, DF \rightarrow AE\}$.

   (a) Compute B^+.
   $$B^+ = BDE$$

   (b) Compute CF^+.
   $$CF^+ = ABCDEF$$

   (c) Compute DF^+.
   $$DF^+ = ADEF$$

   (d) Compute BC^+.
   $$BC^+ = BCDE$$

   (e) Compute ABC^+.
   $$ABC^+ = ABCDE$$

2. Again, suppose we have a relation on attributes $A, B, C, D, E,$ and F,and these functional dependencies hold: $S = \{B \rightarrow DE, BF \rightarrow C, CF \rightarrow B, DF \rightarrow AE\}$.
   Write "yes" or "no" for each, and show your rough work.

   (a) Does it follow from S that $B \rightarrow A$?
   No, because B^+ does not include A from $Q1$ part (a).

   (b) Does it follow from S that $CF \rightarrow E$?
   Yes, because CF^+ includes E from $Q1$ part (b).

   (c) Does it follow from S that $DF \rightarrow B$?
   No, because $DF+$ does not include B from $Q1$ part (c).

   (d) Does it follow from S that $BD \rightarrow C$?
   The closure of BD can be derived from the functional dependencies given, which is

   $$BD^+ = BDE.$$

   No, C can not be derived from BD^+ since BD^+ does not include C.

   (e) Does it follow from S that $BFC \rightarrow A$?
   The closure of BFC can be derived from the functional dependencies given, which is

   $$BFC^+ = ABCDEF.$$

   Yes, A can be derived from BFC^+ since BFC^+ includes A.

3. Suppose we have a relation with attributes $ABCDE$ and these functional dependencies: $S = \{A \to D, B \to A, C \to A, D \to CE.\}$ Project the functional dependencies onto the attribute set ABD.

> By the algorithm introduced in the lecture, compute A^+, B^+, D^+ at first, which is,
>
> $$A^+ = ACDE$$
> $$B^+ = ABCDE$$
> $$D^+ = ACDE$$
>
> Therefore, the aimed dependencies are computed,
>
> $$A \to D$$
> $$B \to AD$$
> $$D \to A$$
>
> Finally, the projection is solved as,
>
> $$\{A \to D, B \to AD, D \to A\}.$$

4. Consider relation $R(A, B, C, D, E, F)$ with functional dependencies:

$$S = \{CD \to A, B \to EF, A \to BC, F \to D\}$$

Create an instance of R that satisfies its FDs and has redundant data. Identify redundancy by circling a single value in the table that could be erased and yet we would know what its value *must* be. Thought exercise: what does it have to do with the FDs?

A	B	C	D	E	F
1	2	3	4	5	6
1	2	3	4	5	6