CSC134 - Spring 2019 - Applebaum

Assignment 6

Total: 100 points

Submission must be typed and submitted as a PDF file to Canvas

1. (20 pts) Given F = { a → b, b → c, c → {d, e} }. What is $\{b\}^+$ (i.e. the closure of b)? Show your steps to achieve the answer.

   Steps: $\{b\}^+ = \{b\}$

   $= \{b, c\}$

   $= \{b, c, d, e\}$ (final answer)

2. (20 pts) Given F = { a → b, c → d, b → {d, e}, {a, b} → c }. What is $\{a\}^+$ (i.e. the closure of a)? Show your steps to achieve the answer.

   Steps: $\{a\}^+ = \{a\}$

   $= \{a, b\}$

   $= \{a, b, d, e\}$

   $= \{a, b, c, d, e\}$

3. (30 pts) Given R(a, b, c, d, e) with two keys, (a,b) and c, and given the following set of functional dependencies F = { {a, b} → {c, d, e}, c → {a, b, d} }.

   a. Is R in 1NF? Justify your answer.

      We don't have enough info to tell – 1NF depends on the semantics

   b. Is R in 2NF? Justify your answer.

      Yes.

      The non-prime attributes are d and e. FD1 tells us d is dependent on {a,b}, FD2 tells us that e is dependent on e. No other FDs exist to make d only partially dependent on {a,b}.

      FD1 tells us that e is dependent on {a, b}. Using the transitive property with FD2 and

FD1, we have c → {a, b} → e, so e is dependent on c as well. No other FDs exist to make e only partially dependent on {a,b}.

c. Is R in 3NF? Justify your answer.

   To be in 3NF, for any non trivial dependency X → A, either X is a superkey or A is a prime attribute. For all our dependencies above, the left side (X) is a key, and therefore a superkey. So R is in 3NF

4. (30 pts) Given R(a, b, c, d, e) with a key (a,b) and given the following set of functional dependencies F = { a → b, {a, b} → c, b → {d, e} }.

   a. Is R in 1NF? Justify your answer.

      We don't have enough info to tell – 1NF depends on the semantics

   b. Is R in 2NF? Justify your answer.

      No, because FD3 tells us that the non-prime attributes d and e are only partially dependent on the key {a, b}.

   c. Is R in 3NF? Justify your answer.

      No, because R is not in 2NF.