CSC 134 Spring 2019

Homework Assignment 6

Total: 100 points

Submission must be typed. Submit a PDF file to Canvas.

1. Given F = {a→b, b→c, c→ {d,e}}. What is the closure of b, $\{b\}^+$? Show your steps to achieve the final answer.
   First, given b→c, we have $\{b\}^+ = \{b\} \cup \{c\} = \{b, c\}$
   Since $\{c\} \subseteq \{b, c\}$
   We have $\{b\}^+ = \{b, c\} \cup \{d, e\} = \{b, c, d, e\}$
   Thus, $\{b\}^+ = \{b, c, d, e\}$

2. Given R(x,y, z, w, k, t). There are two keys: (x,y) and z. Given the following functional dependency: F = { {x,y} → {z,w,k,t}, z → {x,y,w,k,t }, y→t}. Is R in 2nd normal form? Justify your answer.

   Keys: (x, y) , z
   Non-prime attributes: w, k, t
   Is non-prime attribute w fully-functionally dependent on key (x, y)?
   (x, y) → w YES
   Is non-prime attribute k fully-functionally dependent on key (x, y)?
   (x, y) → k YES
   Is non-prime attribute t fully-functionally dependent on key (x, y)?
   y → t YES
   x → t NO, so non-prime attribute t is not fully functionally dependent on key (x, y)
   Therefore, R is NOT in 2nd normal form.

3. Given R(x,y, z, w, k, t). There are two keys: (x,y) and z. Given the following functional dependency: F = { fd1:{x,y} → {z,w,k,t}, fd2: z → {x,y,w,k,t }, fd3:k→ x}. Is R in 3rd normal form? Justify your answer.

   Keys: (x, y), z
   (1): fd1: (x, y) is a super key
   (2): fd2: z is a super key
   (3): fd3: $\{k\}^+ = \{k, x\}$
   k is not a super key, but x is a prime attribute. So, fd3 **satisfied** 3rd normal form condition.
   Thus, R is IN 3rd normal form.

4. Given R(x,y, z, w, k, t). There are two keys: (x,y) and z. Given the following functional dependency: F = { fd1:{x,y} → {z,w,k,t}, fd2: z → {x,y,w,k,t }, fd3: w→ y}. Is R in BCNF? Justify your answer.

   Keys: (x, y), z

(1): fd1: (x, y) is a super key
(2): fd2: z is a super key
(3): fd3: $\{w\}^+ = \{w, y)$
w is not a super key, but y is a prime attribute. So fd3 **satisfied** 3rd normal form condition.
Thus, R is IN 3rd normal form.
Since, R is IN 3rd normal form, we do the check again.
Keys: (x, y), z
(1): fd1: (x, y) is a super key
(2): fd2: z is a super key
(3): fd3: $\{w\}^+ = \{w, y)$
w is not a super key. So fd3 **violated** BCNF condition.
Thus, R is NOT in BCNF.