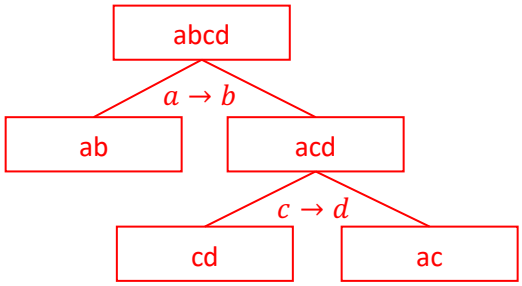
CSCI3170 Short Assignment #3 (Solution)

Name: Pass / Fail

Student ID:

1. Consider the following relation and functional dependencies:
   R(a,b,c,d)
   F = {a→b, c→d}
   a) Give a BCNF decomposition of R. Please show your steps.

   Ans:



   Therefore, R(a,b,c,d) is decomposed into R_1(a,b), R_2(c,d) and R_3(a,c) .

   b) Prove that your decomposition is a lossless-join decomposition.
   Ans:

   Consider the decomposition in two steps:

   Step 1: Decompose R(a,b,c,d) into R_1(a,b) and R'(a,c,d)
   Since the common attribute between R_1 and R' is a, and a is the key of R_1, the decomposition is lossless-join.

   Step 2: Decompose R'(a,c,d) into R_2(c,d) and R_3(a,c)
   Since the common attribute between R_2 and R_3 is c, and c is the key of R_2, the decomposition is lossless-join

2. Consider the following relation and functional dependencies:
   R(a,b,c,d,e)
   F = {ab→cd, c→d}

   a) List the candidate key of R
      Ans:
      The key is abe

   b) Find the canonical cover of F
      Ans:
      F_c={ab→c, c→d}

   c) Give a 3NF decomposition of R. Briefly explain your answer.
      Ans:
      For ab→c, create R_1(a,b,c)
      For c→d, create R_2(c,d)
      As the key abe is not contained in R_1 and R_2, R_3(a,b,e) is created.

      Therefore, R(a,b,c,d,e) is decomposed into R_1(a,b,c), R_2(c,d), and R_3(a,b,e).