CS1555 Recitation 10 Solution

Objective: to practice normalization, finding canonical forms.

Part 1: For each of the following relations R and sets of functional dependencies F, find the canonical cover (minimal cover) of F.

1. Consider the following set of functional dependencies F on a relation R (A, B, C, D, E):

$A \rightarrow BC$
$A \rightarrow D$
$B \rightarrow C$
$C \rightarrow D$
$DE \rightarrow C$
$BC \rightarrow D$

Finding the canonical form:

- Transform all FDs to canonical form (i.e., one attributes on the right):
  $A \rightarrow B$
  $A \rightarrow C$
  $A \rightarrow D$
  $B \rightarrow C$
  $C \rightarrow D$
  $DE \rightarrow C$
  $BC \rightarrow D$

- Drop extraneous attributes:
  B in $BC \rightarrow D$ is extraneous, since we already have $C \rightarrow D$. The set of FDs becomes:
  $A \rightarrow B$
  $A \rightarrow C$
  $A \rightarrow D$
  $B \rightarrow C$
  $C \rightarrow D$
  $DE \rightarrow C$

- Drop redundant FDs:
  A → B and B → C implies A → C, so we drop A → C.
  A → B, B → C and C → D implies A → D, so we drop A → D.
  The set of FDs becomes:
  A → B
  B → C
  C → D
  DE → C
  which is the canonical cover of F.

2. Consider the following set of functional dependencies F on relation R (A, B, C, D, E, H):

A → C
AC → D
E → AD
E → H
A → CD
E → AH

Finding the canonical form:

- Transform all FDs to canonical form (i.e., one attribute on the right):
  A → C
  AC →D
  E → AD becomes E →A and E→D
  E → H
  A→ CD becomes A→C and A→D
  E → AH becomes E→A and E→H
- Remove redundant dependencies:
  A → C
  AC → D
  E → A
  E → D
  E → H
  A → D

- Drop extraneous attributes:
  AC→D can be removed because we have A→D so C is redundant:
  $A \rightarrow C$
  $E \rightarrow A$
  $E \rightarrow D$
  $E \rightarrow H$
  $A \rightarrow D$

- Drop redundant FDs:
  Try removing some dependencies in F and still have a set of dependencies equivalent to F.
  E→D can be deduced from E→A and A→D so we can remove E→D.
  The set of FDs becomes:
  A→C
  E→A
  E→H
  A→D
  which is the canonical cover of F.