University of Toronto
CSC343

In-class Exercises: Properties of Decompositions

1. **A lossy join decomposition.** Suppose we have a relation with attributes cdf, name, grade. Here is an instance of that relation:

cdf	name	grade
g3tout	Amy	91
g4foobar	David	78
c0zhang	David	85

(a) Suppose we were to decompose this into two new relations: R1(cdf, name) and R2(name, grade). Project the data onto those two new relations.

R1:

cdf	name

R2:

name	grade

(b) Now compute $R1 \bowtie R2$ to rebuild the original table.

cdf	name	grade

(c) What was lost?

2. **A decomposition that fails to preserve dependencies** [Example 3.25 from the text.] Suppose we have a relation with attributes movie, theatre, city and FDs { theatre → city; movie, city → theatre }. The FD theatre → city violates BCNF, and applying the BCNF decomposition algorithm, we get two new relations:

   - R1(theatre, city) with one FD: theatre → city
   - R2(theatre, movie) with no FDs

   (a) Create small instances of R1 and R2 that satisfy their own FDs, but when natural-joined together, violate one of the original FDs.

R1:

theatre	city

R2:

theatre	movie

R1 ⋈ R2:

theatre	city	movie

   (b) In the original relation, with attributes movie, theatre, city, does the functional dependency theatre → city violate 3NF?

   (c) In the original relation, with attributes movie, theatre, city, does the functional dependency theatre → city violate BCNF?