# 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?