

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

- | cdf | name |
|-----|------|
| | |

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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 \rightarrow city; movie, city \rightarrow theatre }. The FD theatre \rightarrow city violates BCNF, and applying the BCNF decomposition algorithm, we get two new relations:

- R1(theatre, city) with one FD: theatre \rightarrow 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.

Solution: Here is one example answer.

R1:

| theatre | city |
|------------------|---------|
| Kingsway Theatre | Toronto |
| Varsity Cinema | Toronto |

R2:

| theatre | movie |
|------------------|------------|
| Kingsway Theatre | The Matrix |
| Varsity Cinema | The Matrix |

R1 \bowtie R2:

| theatre | city | movie |
|------------------|---------|------------|
| Kingsway Theatre | Toronto | The Matrix |
| Varsity Cinema | Toronto | The Matrix |

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

Solution:

No, city is part of the key (city, movie).

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

Solution:

Yes, because theatre is not a key. It does not functionally determine movie.