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CSE 132A
Homework 2

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1. Let R be a relation with attributes ABCD. Consider SQL conjunctive query

```
SELECT z.D
FROM R x, R y, R z
WHERE y.C = 0 and x.B = y.B and z.B = 5
      and z.C = y.C
```

(i) PATTERN

R	A	B	C	D
x	—	b	—	—
y	—	b	0	—
z	—	5	0	d

ans	D
	d

(ii) Minimize, satisfying FD's

$A \to D, CD \to B, C \to A$

R	A	B	C	D
x	—	b	—	—
y	—	~~5~~	0	~~d~~ d
z	—	5	0	d

→

R	A	B	C	D
	—	5	0	d

ans	D
	d

(iii)
```
SELECT D
FROM R
WHERE B = 5 and C = 0;
```

2. Let R be a relation with attributes ABCDEG and $F = \{E \to D, C \to B, CBE \to AG, B \to A, G \to E\}$.

(i) Find all keys of R.

F : $E \to D$

$C \to B$

$CBE \to AG$

$B \to A$

$G \to E$

L	M	R
C	B,E,G	A,D

× $C^+ = CBA$

× $CB^+ = CBA$

✓ $CE^+ = CBEDAG$

✓ $CG^+ = CBGEAD$

✓ $CBE^+ = CBEAGD$

✓ $CEG^+ = CBAGED$

✓ $CEG^+ = CBEAGD$

Keys: CE, CG

ABCDEG

F: {E → D, C → B, CBE → AG, B → A, G → E}

(ii) BCNF decomposition of R with lossless join

violation: E → D $(ED)^+ = ED$

ED ABCEG

violation: C → B $(C)^+ = CBA$

CB ACEG

violation: B → A

BA CEG

violation: G → E

GE CG

Decomposition: (ED, CB, BA, GE, CG)

(iii) is decomposition dependency preserving?

F: {E → D, C → B, CBE → AG, B → A, G → E}

Decomposition: ED, CB, GE, BA, CG

CBE → AG is not preserved

(iv) 3NF with lossless & dependency preservation

1. rewrite FD w/ single att on RHS

E → D, C → B, CBE → A, CBE → G, B → A, G → E

2. Eliminate redundant FD's

C → B, B → A, G → E, E → D, ~~CBE → A~~, ~~CBE → G~~

3. Eliminate redundant att from LHS of FD's

P = {CB, BA, GE, ED, CEG} SUPERKEY

P has lossless join.

Is P also BCNF? NO, because only one of the dependency is a candidate key and the rest are not, so they violate BCNF.