

Due on Friday, March 3, 11:59pm (see instructions)

This is an **individual** assignment.

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

```
select x.B, x.C, x.D
```

```
from R x, R y, R z
```

```
where x.B = y.B and z.B = 8 and x.A = x.C
```

```
and x.D = y.C and z.A = y.C and z.C = x.A
```

(i) (2 points) Construct the pattern corresponding to the query.

R	A	B	C	D
x	a	b	a	d
y	-	b	d	-
z	d	8	a	-

answer	B	C	D
	b	a	d

(ii) (2 points) Is the pattern constructed in (i) minimal? (Explain)

The pattern constructed in (i) is minimal. Because each table (x, y and z) is not same and is used exactly once in the query. We cannot delete any row in the table, so it is the minimal.

- (iii) (5 points) Minimize the pattern in (i) knowing that the query is only applied to databases satisfying the FD's

$$B \rightarrow A, A \rightarrow C, C \rightarrow D$$

Show the intermediate steps.

1. I first consider $B \rightarrow A$, which is violated by rows (x) and (y). Chasing leads us to identify the - in (y) with a, yielding:

R	A	B	C	D
x	a	b	a	d
y	a	b	d	-
z	d	8	a	-

2. I consider $A \rightarrow C$, which is violated by rows (x) and (y). Chasing leads us to identify the d in (y) with a. Since $x.D = y.C$ and $z.A = y.C$, I can rewrite x.D and z.A, yielding:

R	A	B	C	D
x	a	b	a	a
y	a	b	a	-
z	a	8	a	-

3. I consider $C \rightarrow D$, which is violated by rows (y) and (z). Chasing leads us to identify the - in (y) and (z) with a, yielding:

R	A	B	C	D
x	a	b	a	a
y	a	b	a	a
z	a	8	a	a

The above pattern satisfies F, so the chase is done.

Eliminating duplicate rows from $CHASE_F(P)$ yields the following pattern, which is minimal:

R	A	B	C	D
x	a	b	a	a
z	a	8	a	a

answer	B	C	D
	b	a	a

- (iv) (1 point) Construct from the minimized pattern a corresponding minimized SQL query.

```
select x.B, x.C, x.D
from R x, R z
where x.A = x.C and x.C=x.D and z.B=8 and x.A=z.A and x.C=z.C and x.D=z.D;
```