

CPSC 368: Databases in Data Science
Practice Exercise on SQL Equivalencies

Two queries are said to be equivalent if they give the same answer for every instance of the database. Consider the following database:

government(name, rank, salary)
politician(name, party, gender)
donation(name, organization, amount)

For each of the following five pairs of SQL queries, determine whether they are equivalent. If they are not, give a database instance as a counter-example. Otherwise, just state that they are equivalent.

1.

Query 1:

```
SELECT name
FROM donation A
WHERE NOT EXISTS (
  SELECT *
  FROM donation B
  WHERE name = 'Campbell' AND NOT
  EXISTS (
    SELECT *
    FROM donation C
    WHERE C.organization =
    B.organization AND C.name =
    A.name
  )
)
```

Query 2:

```
SELECT name
FROM donation A
WHERE NOT EXISTS (
  SELECT *
  FROM donation
  WHERE name = 'Campbell' AND
  organization NOT IN (
    SELECT organization
    FROM donation B
    WHERE B.name = A.name
  )
)
```

2.

Query 1:

```
(SELECT name
FROM government
WHERE salary >= 100000)
UNION
(SELECT name
FROM government
WHERE salary < 100000)
```

Query 2:

```
SELECT name
FROM government
```

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3.

Query 1:

```
(SELECT name
FROM government
WHERE rank = minister)
UNION
(SELECT name
FROM donation
WHERE amount >= 100000)
```

Query 2:

```
SELECT government.name
FROM government, donation
WHERE government.name =
donation.name AND (rank = minister OR
amount >= 100000)
```

4.

Query 1:

```
SELECT name
FROM politician
WHERE name NOT IN (
    SELECT name
    FROM government
)
```

Query 2:

```
SELECT name
FROM politician
WHERE NOT EXISTS (
    SELECT *
    FROM government
    WHERE government.name =
    politician.name
)
```

5.

Query 1:

```
SELECT name
FROM politician
WHERE name NOT IN (
    SELECT name
    FROM government
)
```

Query 2:

```
SELECT politician.name
FROM politician, government
WHERE NOT politician.name =
government.name
```

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Answers:

1. Yes they are equivalent.
2. No. They are not equivalent. If the government relation looked like this:

Name	Salary
Albert	150000
Bobbie	50000
Carly	NULL

The first query would give us {Albert, Bobbie} while the second query would give us {Albert, Bobbie, Carly}.

3. No. They are not equivalent. If the government and donation relations looked like this:

Government Relation

Name	Rank	Salary
Albert	Minister	10000
Bobbie	Clerk	2000

Donation Relation

Name	Organization	Amount
Carly	ABC	150000
Don	DEF	50000

The first query would give us {Albert, Carly} while the second query would give us { }.

4. Yes they are equivalent.
5. No. They are not equivalent. If the government and politician relations looked like this:

Government Relation

Name
Albert
Bobbie

Politician Relation

Name
Albert
Carly

The first query would give us {Carly} while the second query would give us {Albert, Carly }.