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

The donations relation was defined based on the following SQL statement:

```
CREATE TABLE donations (
        recipientName CHAR(20) NOT NULL,
        donorOrganization CHAR(20) NOT NULL,
        organizationType CHAR(20),
        amount REAL,
        PRIMARY KEY (recipientName, donorOrganization)
)
```

Based on the donations relation defined above, determine whether each of the following four pairs of SQL statements is equivalent. If the pair is equivalent, just say yes and no explanation is needed. If you do not think the pair is equivalent, construct an instance of the donations relation to illustrate the difference between the pair of statements.

1.
```
SELECT DISTINCT A.recipientName
FROM Donations A
WHERE NOT EXISTS (
        SELECT B.donorOrganization
        FROM Donations B
        WHERE B.recipientName = “Campbell” AND
                A.donorOrganization ≠ B.donorOrganization
)
```

   vs.

```
SELECT DISTINCT recipientName
FROM Donations A
WHERE NOT EXISTS (
        (SELECT donorOrganization
        FROM Donations
        WHERE recipientName = “Campbell)
        EXCEPT
        (SELECT donorOrganization
        FROM Donations B
        WHERE B.recipientName = A.recipientName)
)
```

2. (SELECT DISTINCT recipientName FROM donations WHERE amount ≥ 500)
   UNION
   (SELECT DISTINCT recipientName FROM donations WHERE amount < 500)

   vs.

   SELECT DISTINCT recipientName FROM donations

3. SELECT DISTINCT recipientName
   FROM donations A, donations B
   WHERE A.amount ≥ 1000 AND A.recipientName = B.recipientName AND
   A.donorOrganization ≠ B.donorOrganization

   vs.

   SELECT DISTINCT recipientName
   FROM donations
   WHERE amount ≥ 1000
   GROUP BY recipientName
   HAVING COUNT(donorOrganization) ≥ 2

4. SELECT DISTINCT recipientName
   FROM donations
   WHERE recipientName NOT IN (
   SELECT recipientName
   FROM donations
   WHERE organizationType = “Library”
)

   vs

   SELECT DISTINCT recipientName
   FROM Donations A
   WHERE EXISTS (
   SELECT *
   FROM Donations B
   WHERE B.recipientName = A.recipientName AND B.organizationType ≠ “Library”
)

Answers

1. No. Consider the instance:

recipientName	donorOrganization	…
John	A	
John	B	
Campbell	A	
Campbell	B	

The top query will return no results while the bottom query will return John and Campbell.

2. No. Consider the instance:

recipientName	Amount	…
John	100	
Campbell	2000	
Mary	Null	

The top query will return {John, Campbell} whereas the bottom query will return all of {John, Campbell, Mary}.

3. No. Consider the instance:

recipientName	donorOrganization	Amount
Campbell	CUPE	100
Campbell	Canucks	2000

The top query will return {Campbell} whereas the bottom query will return nothing.

4. No. Consider the instance:

recipientName	OrganizationType	…
John	Library	
John	Entertainment	
Mary	Sports	

The top query will return {Mary} whereas the bottom query will return {John, Mary}.