

Assignment 4

EECS341 Spring 2019

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Due: Thursday, Feb 28, 2019

1. Find the name of users associated with only the area “Cleveland City”

a. Relational algebra

$$\Pi_{user.name}(\sigma_{user.id = user_role.user_id \wedge user_role.role_id = role_area.role_id \wedge role_area.area_id = area.id}(user \times user_role \times role_area \times area) - \sigma_{user.id = user_role.user_id \wedge user_role.role_id = role_area.role_id \wedge role_area.area_id = area.id \wedge area.name <> 'Cleveland City'}(user \times user_role \times role_area \times area))$$

b. Tuple relational calculus

$$\{t | (\exists u)(u \in user \wedge t[name] = u[name] \wedge (\exists ur)(ur \in user_role \wedge ur[user_id] = u[id] \wedge (\exists ra)(ra \in role_area \wedge ra[role_id] = ur[role_id] \wedge (\forall a)(a \in area \wedge a[id] = ra[area_id] \Rightarrow a[name] = 'Cleveland City')))))\}$$

c. SQL

```
SELECT DISTINCT u.name
FROM user u, user_role ur, role_area ra, area a
WHERE u.id = ur.user_id
      AND ur.role_id = ra.role_id
      AND ra.area_id = a.id
      AND u.id NOT IN (
        SELECT user.id
        FROM user, user_role, role_area, area
        WHERE user.id = user_role.user_id
              AND user_role.role_id = role_area.role_id
              AND role_area.area_id = area.id
              AND area.name <> 'Cleveland City');
```

2. Find the name of users associated with every area except “Cleveland City”

a. Relational algebra

$$\frac{\prod_{user.name, area.id} (\sigma_{user.id = user_role.user_id \wedge user_role.role_id = role_area.role_id \wedge role_area.area_id = area.id} (user \times user_role \times role_area \times area))}{\prod_{area.id} (\sigma_{area.name \neq 'Cleveland City'} (area))}$$

b. Tuple relational calculus

$$\{t | (\exists u)(u \in user \wedge t[name] = u[name] \wedge (\forall a)(a \in area \wedge a[name] \neq 'Cleveland City' \Rightarrow (\exists ur)(ur \in user_role \wedge ur[user_id] = u[id] \wedge (\exists ra)(ra \in role_area \wedge ra[role_id] = ur[role_id] \wedge a[id] = ra[area_id])))\}$$

c. SQL

```
SELECT u.name
FROM user u
WHERE NOT EXISTS (
    SELECT a.id
    FROM area a
    WHERE a.name <> 'Cleveland City' AND a.id NOT IN (
        SELECT area.id
        FROM user_role, role_area, area
        WHERE u.id = user_role.user_id
            AND user_role.role_id = role_area.role_id
            AND role_area.area_id = area.id));
```