

Friday 25th January, 2019

1 SQL Stuff

Definition 1. Let $\mathcal{W} = (\mathcal{C} \cup \times \mathcal{F} \cup (\times \mathcal{F})^2, \approx, \leq, \Pi, \sigma, \ltimes, 1, 2, 3, \dots)$ where

- \mathcal{C} is a set of domain names
- \mathcal{F} is a set of domain sets
- \approx is a relation that compares entries
- \leq is a relation that compares cardinalities
- Π, σ, \ltimes are usual relational algebraic functions
- $1, 2, 3, \dots$ are constant sets with cardinalities $1, 2, 3, \dots$

A database $\mathcal{D} \in (\times \mathcal{F})^2$ is an embedding in \mathcal{W} .

Definition 2 (k -Anonymity). For $k \in \{1, 2, 3, \dots\}$ and $\mathcal{Q} \subseteq \mathcal{C}$, a database \mathcal{D} is k -anonymous in regards to \mathcal{Q} iff it holds that

$$\forall_{d \in \mathcal{D}} \exists_{S \subseteq \mathcal{D}} (S \geq k \wedge \forall_{s \in S} \Pi_{\mathcal{Q}} s \approx \Pi_{\mathcal{Q}} d)$$

A SQL query to discover all the values that violate k -Anonymity is

```
SELECT Q, COUNT(*) AS count FROM D GROUP BY Q HAVING count < k
```

Definition 3 (ℓ -Diversity). For $\ell \in \{1, 2, 3, \dots\}$ and $\mathcal{R} \subseteq \mathcal{C} - \mathcal{Q}$, a database \mathcal{D} that's k -anonymous in regards to \mathcal{Q} is ℓ -diverse in regards to \mathcal{R} iff it holds that

$$\forall_{d \in \mathcal{D}} \exists_{S \subseteq \mathcal{D}} (S \geq k \wedge \forall_{s \in S} \Pi_{\mathcal{Q}} s \approx \Pi_{\mathcal{Q}} d \wedge \Pi_{\mathcal{R}} S \geq \ell)$$

A SQL query to discover all the values that violate ℓ -Diversity is

```
SELECT Q, COUNT(*) AS count FROM
  (SELECT Q FROM D GROUP BY Q, R) AS T
GROUP BY Q HAVING count < \ell
```

Definition 4 ((X,Y)-Privacy). For $k \in \{1, 2, 3, \dots\}$ and $X, Y \subseteq \mathcal{C}$, a database is (X,Y)-anonymous for k iff it holds that

$$\forall d \in \mathcal{D} \exists S \subseteq \mathcal{D} (\Pi_Y S \geq k \wedge \forall s \in S \Pi_X s \approx \Pi_X d)$$

```
SELECT X, count(*) AS count FROM
  (SELECT X, count(*) FROM D GROUP BY X,Y)
AS T GROUP BY X HAVING count < k
```