

$$R \underbrace{\quad}_A \underbrace{S \quad}_B \underbrace{T}_{C_1} \rightarrow R \underbrace{\quad}_A \underbrace{S \quad}_B T$$

$$X_R = \sum_i f_i \}$$

$$X_S = \sum_i g_i \}$$

$$X_T = \sum_i h_i \}$$

$X = X_R X_S X_T$ is unbiased

$$E(X) = \sum_i f_i g_i h_i$$

$$S(B) = S(A)$$

$$f_i \checkmark$$

$$g_{ij} = g_i \delta_{ij}$$

$$h_i \checkmark$$

$$X_S = \sum_i \sum_j g_{ij} \delta_{ij} \}$$

General setup

$$R_1, R_2, \dots, R_m$$

$$c_k \left\{ R \quad \quad \quad \right\} \text{Set}$$

Assume that ~~each~~ an attribute participates in at most one join constraint

For every constraint $c_k(A_i) = R_j(A_i)$ introduce $\{k_i\}$ in every R_i

$$X_k = \sum_{\text{t.c.}} \left. \begin{matrix} \{k_i\} \\ \{k_i\} \\ \dots \end{matrix} \right\} \{k_i\} = \sum_i \sum_j \left. \begin{matrix} \{j\} \\ \{i_1, \dots, i_r\} \\ \dots \end{matrix} \right\} \left. \begin{matrix} \{i\} \\ \{i_1, \dots, i_r\} \\ \dots \end{matrix} \right\} \{k_i\}$$

$X = \prod_i X_i$ is unbiased estimate

R_1 R_2

$$* \sum_{t_1 \in R_1} \dots \sum_{t_m \in R_m} g(t_1, \dots, t_m)$$

$$g(t_1, \dots, t_m) = \prod_{i=1}^m s_i(t_i)$$

Relation factorizable.