

Optimal Database Design Problem

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Mathematical Model

o.f.

$$\max \sum_{c \in C} \sum_{q \in Q} y_{cq} g_{cq} - \sum_{i \in I} z_i f_i$$

s.t.

$$\sum_{i \in I} z_i m_i \leq M$$

$$\sum_{c \in C} y_{cq} \leq 1 \quad \forall q \in Q$$

$$y_{cq} \leq z_i \quad \forall c \in C, q \in Q, i \in I_c$$

$$y_{cq}, z_i \in [0, 1]$$

$y_{cq} = 1$ if config c satisfies query q , 0 otherwise

$z_i = 1$ if index i is built, 0 otherwise

Mathematical Model

Objective Function: the net gain is given by subtracting to the total gain earned by using certain configurations, the indexes building cost. Obviously, we want to maximize that profit.

Constraints:

- Memory used by indexes cannot exceed M
- Each query can be served at most by 1 configuration
- All indexes of a configuration must be built if it serves at least one query.

Domain: the used variables are boolean, so the possible values are $\{0, 1\}$