Michelle's model

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1 Dictionary

- Decision variables:
    - x_i, in which $x_i = 1$ if the feature f_i is active, 0 otherwise.

- Input data
    - $c_i =$ utility value of feature f_i.
    - $F =$ set of all features, in which $|F| = n$.

2 Model

Let F be the set of all features, in which $|F| = n$. Let F^m be the feature model that represents the hierarchical relation between features. We say that the ordered pair of features $(f_p, f_c) \in F^m$ if the feature f_c is a child of f_p. Let $M \subseteq F^m$ be the subset of mandatory relations between features, i.e., if $(f_p, f_c) \in M$, booth features f_p and f_c must be activated or deactivated at the same time.

Now, consider the following Integer Programming formulation:

$$\max \quad \sum_{i}^{n} c_i \cdot x_i \tag{1}$$

subject to:

$$x_i = x_j, \forall (i,j) \in M \tag{2}$$

$$x_i \leq x_j, \forall (i,j) \in F^m \tag{3}$$

$$\sum x_i \geq x_j, \forall (i,j) \in F^m \tag{4}$$

Equation 1 is the objective function. Constraint **??** (1) represents all mandatory relations between features.