

Mathematical Formulation

Goal: Minimize number of courses to satisfy HUB requirements.

- n : total number of available courses
- m : number of HUB requirement categories
- $A \in \{0,1\}^{m \times n}$: requirement matrix where $A_{ji} = 1$ if course i satisfies requirement j
- $b \in \mathbb{Z}_{\geq 0}^m$: required number of credits per requirement
- $\mathcal{G}_1, \dots, \mathcal{G}_k$: groups of course indices with duplicate course codes
- $x_i \in \{0,1\}$: decision variable (1 if course i selected, 0 if not)

Optimize:

$$\text{Minimize } \sum_{i=1}^n x_i$$

Subject to:

- (1) Requirement coverage: $\sum_{i=1}^n A_{ji} x_i \geq b_j \quad \forall j = 1, \dots, m$
- (2) No duplicate course codes: $\sum_{i \in \mathcal{G}_r} x_i \leq 1 \quad \forall r = 1, \dots, k$
- (3) Binary decision variables: $x_i \in \{0,1\} \quad \forall i = 1, \dots, n$