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Aharoni, R.; Erdős, Paul; Linial, N.
Optima of dual integer linear programs. (In English)
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Let A be a 0-1 matrix of dimension $n \cdot m$. Consider the following pair of linear programs

$$\text{(L)} \quad \max x \cdot 1, \quad Ax \leq 1, \quad x \geq 0; \quad \text{(D)} \quad \min y \cdot 1, \quad yA \geq 1, \quad y \geq 0.$$

If integral solution constraints are added, they become dual pairs of packing and covering integer linear programs. Let z and Z be the integral optimum of (L) and (D), and q the common rational optimum of (L) and (D). The main results are that a tight inequality relating z and q, and a best possible bound between z and Z can be found in the following form:

$$z \geq \frac{q^2}{n - (f-1)q^2/m} \geq q^2/n,$$

$$Z \leq \begin{cases} \min(n, 3g) & \text{if } m > e(nz)^{1/2}, \\ m & \text{if } m < e(nz)^{1/2}, \end{cases}$$

where f is the least column sum of A, and $g(nz \ln(m/(nz)^{1/2})^{1/2}$. At end of the paper the autor suggest further interesting directions for research.

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Classification:
90C10 Integer programming
90C27 Combinatorial programming
05C70 Factorization, etc.
90C05 Linear programming

Keywords:
pair of linear programs; packing; covering integer linear programs