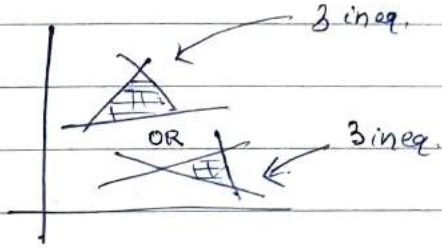
LP FORMULATIONS

cb

$f_i(x) \le b_i$



$f_1(x) \le b_1 + y_1 B$

$f_2(x) \le b_2 + yB$

$f_3(x) \le b_3 + yB$ — constraints on y.

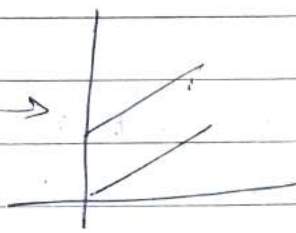
$f_4(x) + b_4 + (1-y)B$ — assume constraint

$\cap$ convex = convex — $x \le By$

$\cup$ convex = $\times$ convex. — x = nonzero when $y = 1$.

$\underline{\underline{K}} + \underline{\underline{Cx}}$

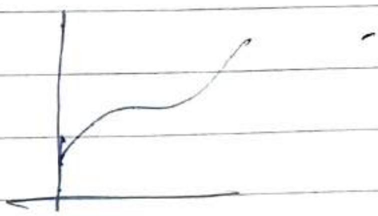
$\downarrow$



$Ky + Cx$

$y \in \{0, 1\}$

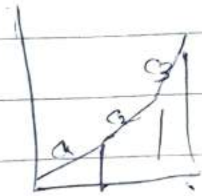
When x is nonzero $y = 1$



$0 \le x_1 \le 4K$ — $C_1x_1 + C_2x_2 + C_3x_3$

$0 \le x_2 \le 5K$

$0 \le x_3 \le 6K$.



optima $= c_1x_1 + c_2x_2 + c_2x_3$

s.t. $0 \le x_1 \le 4k$

$0 \le x_2 \le 5k$

$0 \le x_3 \le 6k$

$4k\omega_1 \le x_1 \le 4k$

$5k\omega_2 \le x_2 \le 5k\omega_1$

$0 \le x_3 \le 6k\omega_2$

$\omega_1, \omega_2 \in \{0, 1\}$.

(1) $\omega_1 = 0 \quad \omega_2 = 0$

$0 \le x_1 \le 4k$

$0 \le x_2 \le 0$

$0 \le x_3 \le 0$

(2) $\omega_1 = 1 \quad \omega_2 = 0$

$4k \le x_1 \le 4k$

$0 \le x_2 \le 5k$

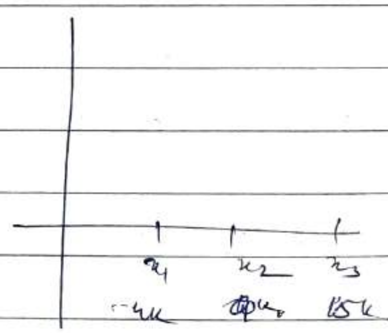
$0 \le x_3 \le 0$.

(3) $\omega_1 = 1 \quad \omega_2 = 1$

$4k \le x_1 \le 4k$

$5k \le x_2 \le 5k$

$0 \le x_3 \le 6k$



$\omega_1 = 0 \quad \omega_2 = 1$

$0 \le x_1 \le 4k$

$5k \le x_2 \le 0$

$0 \le x_3 \le 6k$

BALA'S ALGO

min. $z = 3x_1 + 5x_2 + 6x_3 + 9x_4 + 10x_5 + 10x_6$

st: ——.

— —

——.

$x_i \in \{0, 1\}, \in 1, 2 \ldots 6.$

$x_i = 0$ (all) $c_1 = ×$

$c_2 = ✓$

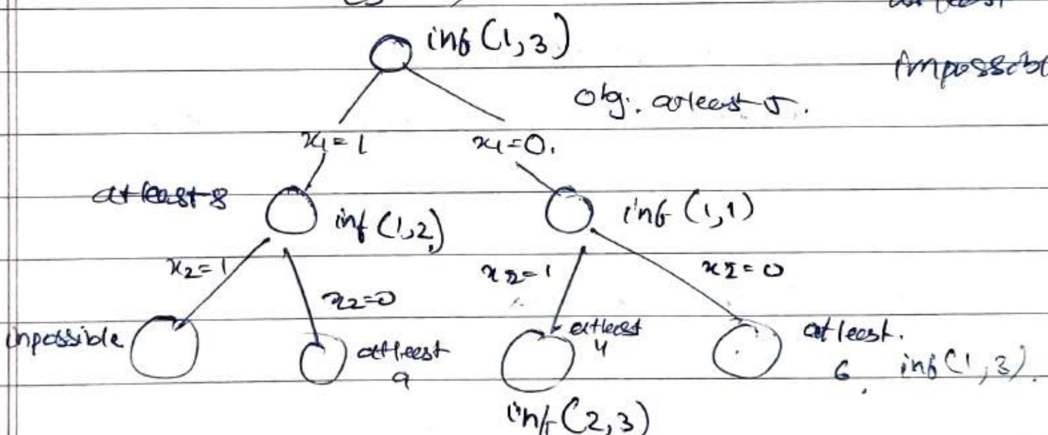
$c_3 = ×$

branches

infeasible

~~atleast~~

impossible.



cozziz | a, a, b, b c ∞

$x \geq 3 * yL$

or

$x \leq -3 - \cancel{g}(1-y)L$

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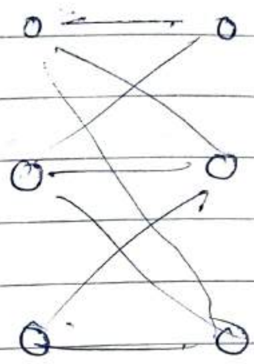
bipartite matching.



max. cut. bipartite matching.

at every vertex only edge.
get max. edge cut.

min. vertex cover.

select set or vertex st.
$x_v \{0, 1\}$
select least no. of vertex.
st. 1 vertex of every edge is selected.

max independent set.

max. set., st. no 2 vertices are
connected by an edge.

LP relaxation - rounding trick.

LOGICAL CONSTRAINTS

$5x_1 + 2x_2 \leq 12$ — true / false.

$5x_1 + 2x_2 \leq 12 + \underline{1000}$ $\longrightarrow$ not necessary.

using binary variable.

$f_1(\bar{x}) \leq b_1 + \cancel{y_1 B_2}$ $+ y_1 B_1$

atleast 1

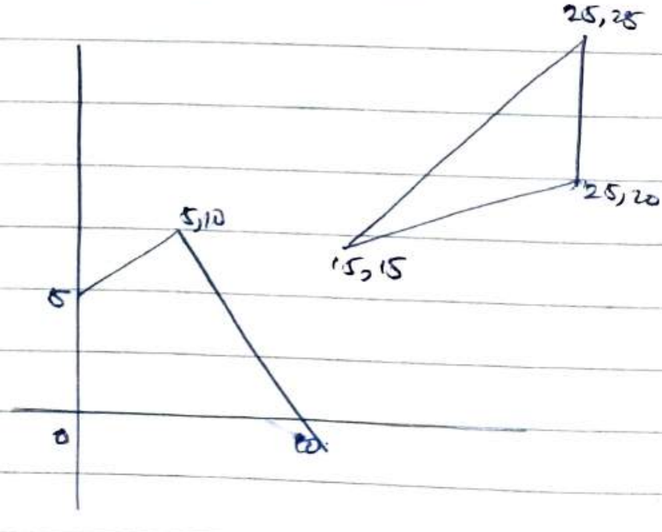
$f_2(\bar{x}) \leq b_2$ $+ y_2 B_2$

$f_1(\bar{x}) \leq b_1 \Rightarrow f_2(\bar{x}) \leq b2$

$A \to B \approx \bar{A} + B$

K-fold alternatives.

f.e must satisfy atleast K of the following p constraints



$x \leq 20$ $\quad y \leq x \quad y = \frac{20-15}{25-15} x +$

$y - y_1 = \frac{y_1 - y_2}{x_1 - x_2}(x - x_1)$

(2) →

$y - 15 = \frac{5}{10}(x - 15)$

$2y - 30 = x - 15$

$-x + 2y \geq 15$

$\sum y_i = 1$

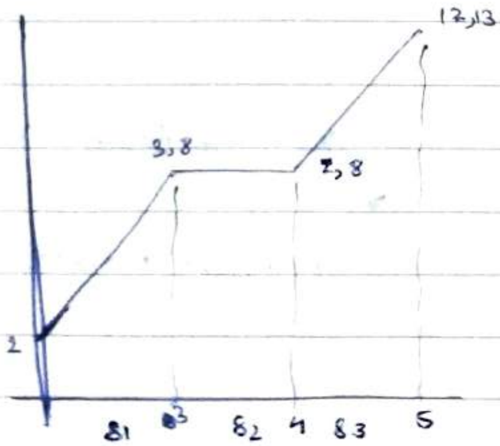
$\sum y_i \leq 1$

FIXED COSTS

$$C = \begin{cases} 0 & x = 0 \\ K + Cx & x > 0 \end{cases}$$

$\bar{c} = Ky + Cx \quad x \leq By$

PIECEWISE LINEAR FUNCTIONS



$C = 2y + 2\delta_1 + 0\delta_2 + \delta_3$

$3w_1 \leq \delta_1 \leq 3y$

$4w_2 \leq \delta_2 \leq 4w_1$

$0 \leq \delta_3 \leq 5w_2$