Multi-Objective LPP

MULTI OBJECTIVE LPP

Maximize / Minimize $Z_1 = c_{11}x_1 + c_{12}x_2 + \cdots + c_{1n}x_n$

$Z_2 = c_{21}x_1 + c_{22}x_2 + \cdots + c_{2n}x_n$

$\vdots$

$Z_k = c_{k1}x_1 + c_{k2}x_2 + \cdots + c_{kn}x_n$

St :

$a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n \ (\leq, =, \geq) \ b_1$

$a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n \ (\leq, =, \geq) \ b_2$

$\vdots$

$a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n \ (\leq, =, \geq) \ b_m$

$x_i \geq 0, \quad i = 1, 2 \cdots n$

Eg : Maximize Marks TOC =

" " OT =

" " SE =

St :

marks secured by stud 1 in TOC = 50

" " " " " OT = 60

" " " " " SE = 65

marks secured by stud 2 in TOC = 65

" " " " " OT = 50

" " " " " SE = 60

	TOC (5cred)	OT (3cred)	SE (4cred)	Avg marks
Stud 1	50	60	65	57.5
Stud 2	65	50	50	59.58 ✓

Who is best ? → difficult to say.

★ Convert Multi Objective → Single objective → avg. elem / weights (like credits)

Max $\xrightarrow{(\text{mult by } -1)}$ Minimize

① equal to : Big M
② all ≤ : Simplex
③ Mix : 2 phase method.

④ 2 var : Graphical.

Q

Maximize = $2x_1 + 3x_2$
Minimize = $x_1 - x_2$
Maximize = $3x_1 + 2x_2$
st :
$x_1 + x_2 \leq 1$
$x_1, x_2 \geq 0$

	(0,0)	(1,0)	(0,1)	
$2x_1 + 3x_2$	0	2	3	(max)
$x_1 - x_2$	0	1	-1	(minimum)
$3x_1 + 2x_2$	0	3 (max)	2	

1st & 2nd → (0,1)
3rd → (1,0)
} we are getting 2 sol^{n}s

Efficient Sol^n or Non-dominant sol^n.

Efficient frontier : A line or curve that is the CLC of effient sol^{n}s is effient frontier.

↳ In this eg eff. front : eff. frontier. $a_1(1,0) + a_2(0,1)$; $a_1 + a_2 = 1$; $a_1, a_2 \geq 0$