Unit-2

Linear Programming Problem (LPP)

1. A carpenter makes book cases in two sizes, small and large. It takes six hours to built a large & two hours to built a small one. The profit from a large book case is ₹50 & profit from a small book case is ₹20. The carpenter can spend only 24 hours a week making book cases. and must make atleast two large and three small each week. find his maximum profit per week.

Slag variable
Surplus variable
ni add chestom
> unrapudu.

large - x
small - y
$6x+2y$

Let large → x,
small → y

obj function is = $50x+20y$ → maximise.

contrains = $6x+2y \le 24$

maximize ≤
minimize ≥

limits $x \ge 2$
$y \ge 3$

A calculater company produces two models of calculaters at two different factory.
factory A can produce 140 scientific calculators and 25 graphic calculaters per day.
factory B can produce 60 scientific calculators & 90 graphic calculaters per day. It costs 1200 ₹ per day to operate factory A & 900 rupees per day to factory B. If the company needs to produce 450 scietific calculators & 340 graphic calculators. Per big order. Find the minimum cost to produce this order.

Let

Factory A : x

Factory B : y

objective function Min = 1200A + 1900B

Contrains: 140A + 60B ≥ 460

25A + 90 ≥ 340

Limits A ≥ 0 , B ≥ 0

A form produces three products. the products are proccessed on three different machines. the time required to manufacture one unit of each 3 objects and daily capacities of the 3 machines are given in the data firm below.

Products	Time required per unit(min)			machine capacity (min/d)
	product 1	product 2	product 3	
A	2	3	2	440
B	4	–	3	470
C	2	5	–	430

It is required to determine the daily number of digits to be manufactured for each product. the profit for unit 1, 2, 3 are 4 ru, 3 ru, 6 ru respectively. It is assume that all the amounts produced (or) Consumed in the market. Formulate the problem as L.P.P.

let product 1 - x_1

product 2 - x_2

product 3 - x_3

obj function $4x_1 + 3x_2 + 16x_3$

Constrains : $2x_1 + 3x_2 + 2x_3 \leq 440$

$4x_1 + 3x_3 \leq 470$

$2x_1 + 5x_2 \leq 430$

$x_1 \geq 0$

$x_2 \geq 0$

$x_3 \geq 0$

- A person requires 10, 12 & 12 units of chemicals a, b & c respectively for his Garden. A liquid product contains 5, 2 & 1 units of a, b, c respectively for jar. A dry product contains 1, 2, & 4 units of a, b, c per bag. If the liquid product is sold for three rupees per jar, the dried product is sold per 2 ₹ per bag. How many units of each product should be purchased in order to minimize cost.

min obj function → $3x_1 + 2x_2$

constrains - $5x_1 + x_2 \geq 10$

$2x_1 + 2x_2 \geq 12$

$x_1 + 4x_2 \geq 12$

$x_1, x_2 \geq 0$

A company manufactures two products x & y which requires the following resources. the resources are the capacities of machines m_1, m_2 m_3 the available capacities are 50, 25 & 15 hours respectively in the planning period. product x requires 1 hour of machine m_2 & 1 hours of machine m_3. Product y requires 2 hours of machine m_1 & 2 hours of machine m_2, 1 hour of machine m_3 the profit contribution of products x & y are 5₹ & 4₹ respectively. Formulate the LPP:

$5x+4y$ x & y

$m_1, m_2, m_3 \to 50, 25, 15$ $x \to m_2$ 1 m_3, 0 m_1

$2x_2 \leq 50$ $m_2 \to$ 1 hours m_1, 1 m_2, 1 m_3

$x_1 + 2x_2 \leq 25$ $m_3 \to$ 1 hour

$x_1, x_2 \geq 0$

$x_3 + x_2$ $y \to$ $m_1 \to 2$ hours

$m_2 \to 2$ hours

$m_3 \to 1$ hours.

obj function $\max = 5x+4y$.

Constrains $0x + m_2$ $0x + 2y \leq 50$ $x \geq 0$

$x+2y \leq 25$ $y \geq 0$

$x+y \leq 15$

A firm manufactures two types of products A & B and sells them at a profit \$2 on type A and \$3 on type B. each product on two machines m_1 & m_2. Type A requires 1 minute of processing time on m_1 and 2 minutes on m_2. Type B requires 1 minute on m_1 and 1 minute on m_2. machine m_1 is available for not more than 6 hours and 40 minutes while machine m_2 is available for 10 hours during working day. Formulate the problem an LPP so as to maximize the profit.

A B

S_2 $S_3 \rightarrow$ profits

M_1 & M_2 M_1 & M_2

$\downarrow$ $\downarrow$ $\downarrow$ $\downarrow$

1M 2M 1M 1M

≤6h 40h 10h

6h 40m

400 min

600

$S_2x + S_3y$

$x + y \le 400m$

$2x + y \le 600m$

Graphical method. → slag variables ni consider cheyyam

To solve the following LPP by using graphical method.

minimize $z = 4x_1 + 6x_2$ is subjected to constrains

$x_1 + x_2 \ge 8$, $6x_1 + x_2 \ge 12$, $x_1, x_2 \ge 0$

min $z = 4x_1 + 6x_2$

Given constrains $x_1 + x_2 \ge 8$

$6x_1 + x_2 \ge 12$

Converting inequalities into equalities

$x_1 + x_2 = 8$ —— (1)

$6x_1 + x_2 = 12$ —— (2)

From eqn (1) $x_1 + x_2 = 8$

at $x_1 = 0$

$\boxed{x_2 = 8}$

at $x_2 = 0$

$\boxed{x_1 = 8}$

From eqn (2)

$6x_1 + x_2 = 12$

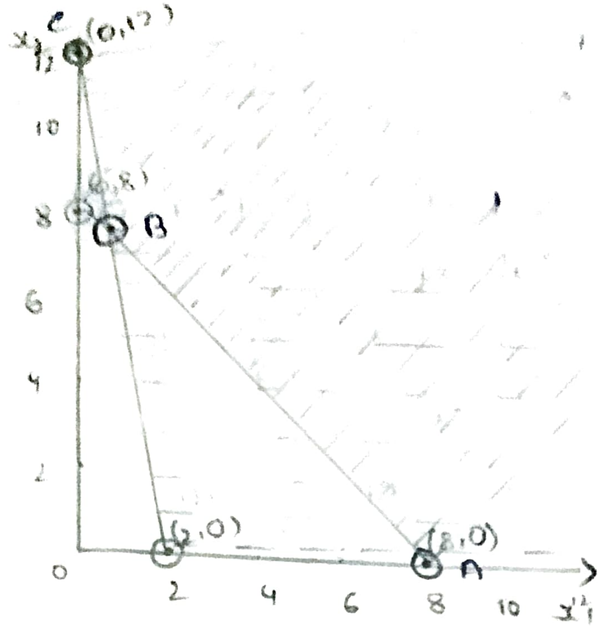
$x_1 = 0$

$\boxed{x_2 = 12}$

$x_2 = 0$

$\boxed{x_1 = 2}$

Graph representation.



$\geq$ out side
$\leq$ inside.

From graph ABC are the feasible region.

Solving ① & ②

$x_1 + x_2 = 8$

$6x_2 + x_2 = 12$

$5x_2 = 4$

$x_2 = 4/5 = 0.8$.

$x_1 = 7.2$

B (0.8, 7.2)

minimize $z = 4x_1 + 6x_2$

$A(8,0) = 4(8) + 6(0) = 32$

$B(0.8, 7.2) = 4(0.8) + 6(7.2) = 46.4$

$C(0,12) = 4(0) + 6(12) = 72$.

At A(8,0) is minimum value is 32.

Solve the following LPP by using graphical method

maximize $z = 12x_1 + 16x_2$ is subjected to constrains

$10x_1 + 20x_2 \leq 120$, $8x_1 + 8x_2 \leq 80$. $x_1, x_2 \leq 0$

Given max $z = 12x_1 + 16x_2$

Given Constrains $10x_1 + 20x_2 \leq 120$

$8x_1 + 8x_2 \leq 80$

Converting inequalities into equalities

$$10x_1 + 20x_2 = 120 \quad \text{— ①} \rightarrow 8x_1 + 2x_2 = 80 \quad 12$$

$$8x_1 + 8x_2 = 80 \quad \text{— ②} \qquad x_1 + x_2 = 10$$

From equation ①

at $x_1 = 0$

$x_2 = \frac{120}{20}$

$\boxed{x_2 = 6}$

at $x_2 = 0$

$10x_1 = 120$

$\boxed{x_1 = 12}$

From equation ②

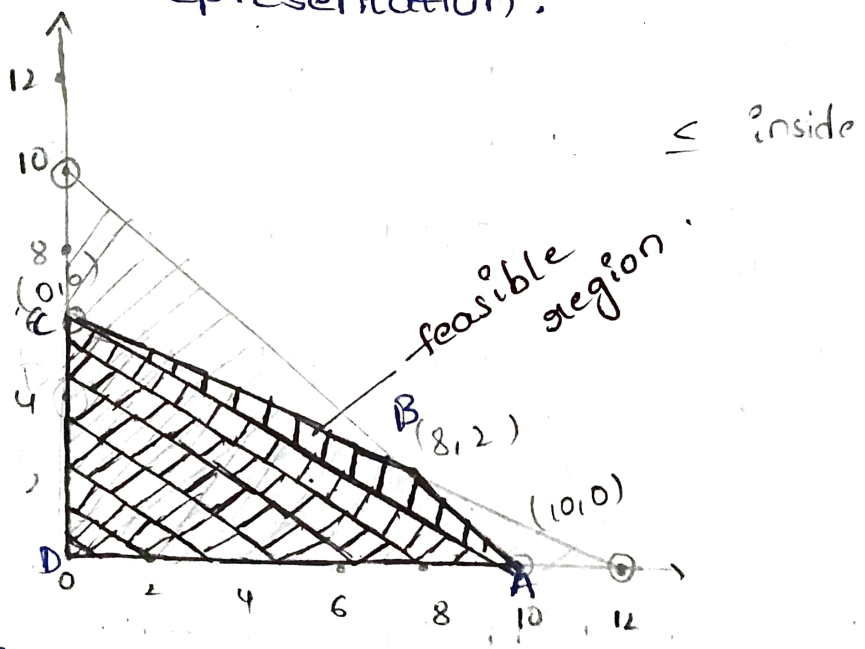
at $x_1 = 0$

$x_2 = \frac{80}{8} = 10$

$x_2 = 0$

$x_1 = \frac{80}{8} = 10$

Graphical representation.



Solving ① & ②

$$80x_1 + 160x_2 = 840$$
$$-\;80x_1 + 80x_2 = 800$$
$$80x_2 = 40$$
$$x_2 = \frac{40}{80} = 0.5$$

$(x_1, x_2) = (9.5, 0.5)$

Substituting x_2 in ②

$$8x_1 + 8(1/2) = 80$$
$$8x_1 = 80 - 4$$
$$8x_1 = 76$$
$$x_1 = \frac{76}{8} = \frac{19}{2}$$
$$= 9.5$$

Solve the maximum L.L.P by using Graphical method maximize $z = 12x_1 + 16x_2$ is subjected to constrains $10x_1 + 20x_2 \le 120$, $8x_1 + 8x_2 \le 80$

Solving ① & ②

$$x_1 + 2x_2 = 12$$
$$x_1 + x_2 = 10$$
$$x_2 = 2$$

Substituting

$\boxed{x_1 = 8}$

obj function $z = 12x_1 + 16x_2$

At A $(10,0) = 120$

At B $(8,2) = 96 + 32 = 128$

At C $(0,6) = 16(6) = 96$

A, B, C D is feasible region.

∴ The maximum value is at B with 128 value.

3. Solve LLP using Graphical method maximize $z = 100x_1 + 60x_2$ is subjected to constrains $5x_1 + 10x_2 \le 50$, $8x_1 + 2x_2 \ge 16$, $3x_1 - 2x_2 \ge 6$, $x_1, x_2 \ge 0$.

Given that

$$\max z = 100x_1 + 60x_2$$

$5x_1 + 10x_2 \le 50$, $8x_1 + 2x_2 \ge 16$, $3x_1 - 2x_2 \ge 6$

Converting inequalites in equalites

$5x_1 + 10x_2 = 50$ — ①

$8x_1 + 2x_2 = 16$ — ②

$3x_1 - 2x_2 = 6$ — ③

From eq^n ①

$$5x_1 + 10x_2 = 50$$

Let $x_1 = 0$ $\boxed{x_2 = 5}$

Let $x_2 = 0$ $\boxed{x_1 = 10}$

x_1	0	10
x_2	5	0

From eq^n (2). $8x_1+2x_2=16$

let $x_1=0$

~~$5(0)+10x_2=5$~~

$8(0)+2x_2=16$

$\boxed{x_2=8}$

let $x_2=0$

$\boxed{x_1=2}$

x_1	0	2
x_2	8	0

From equation (3) $3x_1-2x_2=6$

let $x_1=0$

$3(0)-2x_2=6$

$\boxed{x_2=-3}$

let $x_2=0$

$3x_1=6$

$\boxed{x_1=2}$

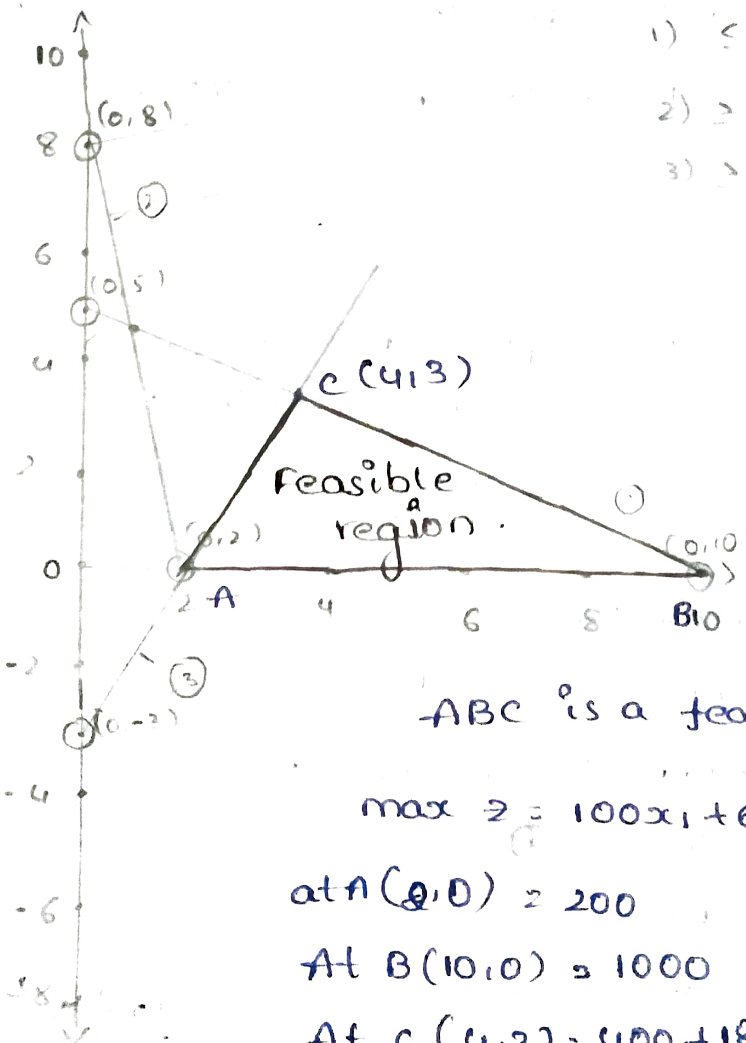
x_1	0	2
x_2	-3	0

Graphical representation.

1) ≤ - inside

2) ≥ - outside

3) ≥ - out



ABC is a feasible region

max $z=100x_1+60x_2$

at A (2,0) = 200

At B (10,0) = 1000

At C (4,3) = 400+180 = 580

∴ Then maximum is the B (10,0) value is of 1000.

Solving (1) & (3)

$5x_1+10x_2=50$

$15x_1-10x_2=30$

$20x_1=80$ $\boxed{x_1=4}$ $\boxed{x_2=3}$

4. To maximize $z = 18x + 10y$ is subjected to constraints $4x + y \leq 20$, $2x + 3y \leq 30$, $x, y \geq 0$

Given that $z = 18x + 10y$

Constraints $4x + y \leq 20$

$2x + 3y \leq 30$

$x, y \geq 0$

Converting inequalities into equalities.

$4x + y = 20$ —— (1)

$2x + 3y = 30$ —— (2)

At $x = 0$ in (1)

$\boxed{y = 20}$

$y = 0$

$\boxed{x = 5}$

x	0	5
y	20	0

At $x = 0$ in (2)

$3y = 30$

$\boxed{y = 10}$

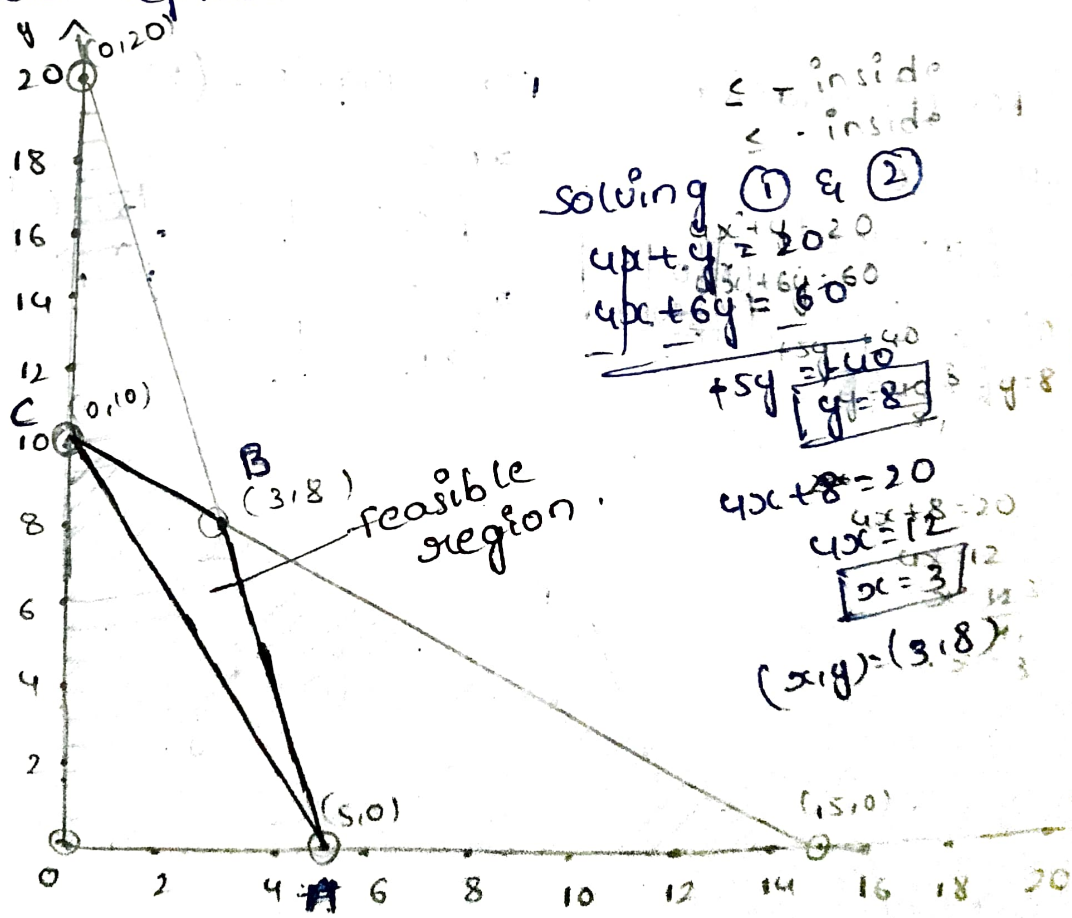
$y = 0$

$2x = 30$

$\boxed{x = 15}$

x	0	15
y	10	0

Graphical representation.



≤ - inside

< - inside

Solving (1) & (2)

$4x + y = 20$

$4x + 6y = 60$

$-5y = -40$

$\boxed{y = 8}$

$4x + 8 = 20$

$4x = 12$

$\boxed{x = 3}$

$(x, y) = (3, 8)$

ABC is a graphical feasible region.

objective function : $18x + 10y$

At A(5,0) : $18(5) + 10(0) = 90$

At B(3,8) : $18(3) + 10(8) = 54 + 80 = 134$

At C(0,10) : $18(0) + 10(10) = 100$

maximize value is 134 At B(3,8)

5. To maximize $z = 3x_1 + 2x_2$ is subjected to Constr

$2x_1 + x_2 \le 100$, $x_1 + x_2 \le 80$, $x_1 \le 40$, $x_1, x_2 \ge 0$

Given $z = 3x_1 + 2x_2$

Constraints $2x_1 + x_2 \le 100$

$x_1 + x_2 \le 80$

Converting inequalities into equalities

$2x_1 + x_2 = 100$ — (1) $\quad x_1 = 40$ — (3)

$x_1 + x_2 = 80$ — (2)

x_1	40
x_2	0

$x_2 = 0$

$x_1 = 40$

$x_1 = 0$

$x_2 = 0$

For (1) equation

At $x_1 = 0$

$\boxed{x_2 = 100}$

At $x_2 = 0$

$\boxed{x_1 = 50}$

x_1	0	50
x_2	100	0

For equation (2)

$x_1 = 0$

$\boxed{x_2 = 80}$

$x_2 = 0$

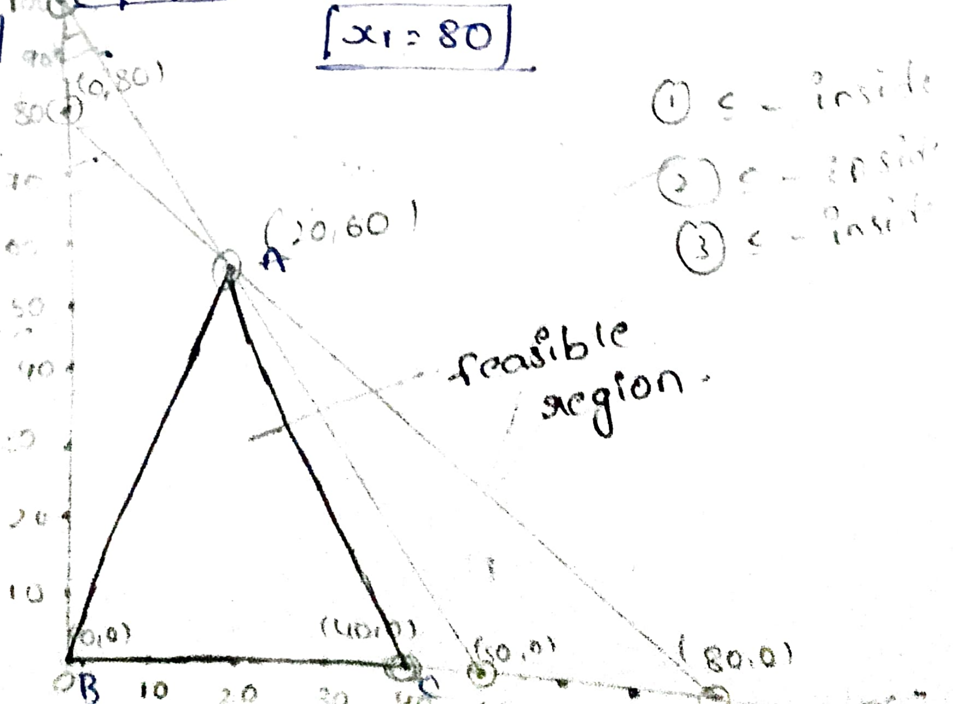
$\boxed{x_1 = 80}$

x_1	0	80
x_2	80	0

(1) ≤ – inside

(2) ≤ – inside

(3) ≤ – inside



Solving (1) & (2)

$$2x_1 + x_2 = 100$$
$$\underline{x_1 + x_2 = 80}$$
$$x_1 = 20$$

$$x_1 + x_2 = 80$$
$$20 + x_2 = 80$$
$$x_2 = 60$$

$(x_1, x_2) = (20, 60)$

$\therefore$ A, B, C is a feasible Solution region.

At $A(20, 60) = 3(20) + 2(60)$
$= 60 + 120 = 180$

At $B(0, 0) = 0$

At $C(40, 0) = 3(40) + 2(0) = 120$

$\therefore$ The maximum value is at $A(20, 60)$ the value is 180.

Simplex method. $(c_j - z_j \leq 0) = \Delta_j$

Process → we will solve this problem in only when maximize objective equation.

if they given in minimize then we need to convert into maximize by interchanging symbols.

Step-2: Converting Inequalities into equalities with slag variables & surplus variables.

After we take table.

coefficients of obj function

basic variables - slag variables

Initial solution.

c_b	bv	x_1	x_2	s_1	s_2	x_b
0	s_1	coefficients of constraint				10
	s_2					50

Basic coefficients of slag variables in obj function

Constraint in equalities

$z_j = c_b \times x_0$ & add all

$c_j - z_j \leq 0$

Suppose $2x_1+4x_2$ is obj function with

$2x_1+2x_2 \le 10$, $x_1+4x_2 \le 50$

coefficients.

obj function $2x_1+4x_2+0S_1+0S_2$

$$2x_1+2x_2+S_1=0$$

$$x_1+4x_2+S_2=0$$

$c_j - z_j \le 0 \rightarrow$ Edi vache varaku chesune undali After this condition satisfies then we get x_1, x_2 values. Those values will be substituted into obj function. i.e the final Answer.

This is the process to solve simplax method.

Examples

1) maximize $z=3x_1+6x_2$ is subjected to constrains $4x_1+7x_2 \le 8$, $3x_1+9x_2 \le 5$, $x_1, x_2 \ge 0$

obj function max: $z=3x_1+6x_2$.

Converting inequalities into equalities with slag variables

$$4x_1+7x_2+S_1=8$$

$$3x_1+9x_2+S_2=5$$

2) minimise $z=4x_1+7x_2$ is subjected to constrains $x_1+2x_2 \ge 2$, $3x_1+5x_2 \ge 7$, $x_1, x_2 \le 0$

obj fun min $z=4x_1+7x_2$,

max: $z=-4x_1-7x_2$

Now converting inequalities into equalities with slag variables

$x_1+2x_2 \ge 2 \Rightarrow -x_1-2x_2 \le -2$

$= -x_1-2x_2+S_1=-2$

$3x_1+5x_2 \geq 7 \Rightarrow -3x_1-5x_2 \leq -7$

$= -3x_1-5x_2+S_2 = -7$

3. maximise $z = 2x_1+6x_2$ is subjected to constraint

$3x_1+4x_2 \leq 5$, $2x_1+9x_2 \geq 7$, $4x_1+5x_2 \geq 9$ $x_1, x_2, x_3 \leq 0$

obj function max : $z = 2x_1+6x_2$

Converting inequalities into equalities with slag variables.

$3x_1+4x_2 \leq 5 \Rightarrow 3x_1+4x_2+S_1 = 5$

$2x_1+9x_2 \geq 7 \Rightarrow -2x_1-9x_2 \leq -7$ (or) $2x_1+9x_2-S_2 = 7$

$= -2x_1-9x_2+S_2 = -7$

$4x_1+5x_2 \geq 9 \Rightarrow -4x_1-5x_2 \leq -9$ (or) $4x_1+5x_2-S_3 = 9$

$= -4x_1-5x_2+S_3 = -9$

Simplux Method.

Solve the following lpp by using the simplux method. maximize $z = 12x_1+16x_2$ is subjected to constrains $10x_1+20x_2 \leq 120$, $8x_1+8x_2 \leq 80$ $x_1, x_2 \geq 0$

Given maximize $z = 12x_1+16x_2$

Given Constrains $10x_1+20x_2 \leq 120$

$8x_1+8x_2 \leq 80$

Converting inequalities into equalities by adding slag variables.

$10x_1+20x_2+S_1 = 120$

$8x_1+8x_2+S_2 = 80$.

Now obj function $(z) = 12x_1+16x_2+0S_1+0S$

Tabular-format

I

coefficients of basic variables c_b	c_j / basic variables b_v	12 x_1	16 x_2	0 s_1	0 s_2	x_b	Ratio
0	s_1	10 (0)	$\boxed{20}$	1	0	$120/20$	$= \boxed{6}$ ← min
0	s_2	8 (0)	8	0	1	$80/8$	$= 10$
	z_j	0	0	0	0		
	$\Delta_{ij} = c_j - z_j$	12	16	0	0		

coefficient of obj-function

$z_j = c_b \times x_1 + c_b \times x_1$

↑ max.

Eleminating s_1 row in that place we generate New key equation (NKE)

$x_1 : 8$

$x_2 : 2$

$$NKE = \frac{\text{old key equation}}{\text{key element}}$$

where key element → intersection value of both column & row.

$$NKE = \frac{10 \quad 20 \quad 1 \quad 0 \quad 120}{20} \Rightarrow \frac{1}{2} \quad 1 \quad \frac{1}{20} \quad 0 \quad \cancel{\tfrac{3}{10}}\,6$$

Sol: New s_2 = old s_2 - corresponding NKE

old s_2 =	8	8	0	1	80
Corr. NKE =	4	8	$\frac{2}{5}$	0	48
New s_2	4	0	$-\frac{2}{5}$	1	32

II

	c_j	12	16	0	0		
c_b	bv	x_1	x_2	S_1	S_2	x_b	Ratio
16	x_2	$\boxed{1/2}$	1	$1/20$	0	6	$= \frac{6}{1/2} = 12$
0	S_2	$\boxed{4}$	0	$-\frac{2}{5}$	1	32	$= \frac{32}{4} = 8$ ← min
	$z_j =$	8	16	$4/5$	0		
	$\Delta_{ij} = c_j - z_j =$	4	0	$-4/5$	0		
		↑ max.					

Eleminating S_2 row in that place we generate New key equation (NKE)

$$NKE = \frac{4 \quad 0 \quad -\frac{2}{5} \quad 1 \quad 32}{4} = 1 \quad 0 \quad -\frac{1}{10} \quad 1/4 \quad 8$$

New x_2 = old x_2 - corresponding NKE

old x_2 = $1/2 \quad 1 \quad 1/20 \quad 0 \quad 6$

Corr NKE = $1/2 \quad 0 \quad -1/20 \quad 1/8 \quad 4$

New x_2 = $0 \quad 1 \quad \frac{1}{10} \quad -1/8 \quad 2$

III

	c_j	12	16	0	0	
c_b	bv	x_1	x_2	S_1	S_2	
16	x_2	0	1	$1/10$	$-1/8$	2
12	x_1	1	0	$-1/10$	$1/4$	8
	$z_j =$	12	16	$2/5$	1	
	$\Delta_{ij} = c_j - z_j =$	0	0	$-2/5$	-1	

$\Delta_{ij} = c_j - z_j \leq 0$ so the solution

Substituting x_1, x_2 values in obj function

obj function $z = 12x_1 + 16x_2$

$= 12(8) + 16(2) \Rightarrow 96 + 32$

$= 128$.

$\therefore$ The maximize optimum value is 128.

Solve the following LPP by using simplex method.
maximize $z = 18x + 10y$ is subjected to $4x + y \leq 20$, $2x + 3y \leq 30$

Given $z = 18x + 10y$

Converting inequalities into equalities with slag variables..

$$4x + y + s_1 = 20$$
$$2x + 3y + s_2 = 30$$

obj function $z = 18x + 10y + 0s_1 + 0s_2$

	c_j	18	10	0	0		
c_b	bv	x	y	s_1	s_2	x_b	ratio.
0	s_1	$\boxed{4}$	1	1	0	20	$20/4 = 5$ ← min.
0	s_2	2	3	0	1	30	$30/2 = 15$
	$z_j =$	0	0	0	0		
	$\Delta_{ij} = c_j - z_j =$	18 ↑	10	0	0		

... nating s_1 in that place we replace

... equation.

$$NKE = \frac{4 \quad 1 \quad 1 \quad 0 \quad 20}{4} = 1 \quad 1/4 \quad 1/4 \quad 0 \quad 5$$

$NKE = 1 \quad 1/4 \quad 1/4 \quad 0 \quad 5$

New S_2 = old S_2 - corresponding S_2 NKE

old S_2 = 2 3 0 1 30

c. NKE = 2 1/2 1/2 0 10

0 5/2 -1/2 1 20

New S_2 = 0 5/2 -1/2 1 20

ii.

	c_j	18	10	0	0		
C_b	bv	x	y	S_1	S_2	x_b	ratio
18	x	1	1/4	1/4	0	5/1/4	20
0	S_2	0	$\boxed{5/2}$	-1/2	1	20/5/2	8 ←
	z_j	18	9/2	9/2	0		
	$\Delta_{ij}=c_j-z_j$	0	11/2	-9/2	0		

↑ max

Eliminating S_2 in that place we replace.

NKE

$$NKE = \frac{0 \quad 5/2 \quad -1/2 \quad 1 \quad 20}{5/2} = 0 \quad 1 \quad -1/5 \quad 2/5 \quad 8$$

NKE = 0 1 -1/5 2/5 8

New x = old x - c. NKE

old x = 1 $1/4$ $1/4$ 0   5

c. NKE = 0 $1/4$ $-1/20$ $1/10$ 2

New x = 1   0 $3/10$ $-1/10$ 3

III

	c_j	18	10	0	0		
C_b	bv	x	y	S_1	S_2	x_b	ratio
18	x	1	0	$3/10$	$-1/10$	3	
10	y	0	1	$-1/5$	$2/5$	8	

z_j = 18   10 $\frac{17}{5}$ $11/5$

$\Delta_{ij} = c_j - z_j$ = 0   0 $-\frac{17}{5}$ $-11/5$

$\therefore c_j - z_j \le 0 \quad \therefore x = 3,\ y = 8$

$\therefore$ obj function = $18(3) + 10(8)$

$= 54 + 80$

$= 134$

$\therefore$ The max value is 134

max max

Standard form of a linear programming problem

The standard form of a linear programming (LP) problem.

maximize or minimize:

$$z = c_1x_1 + c_2x_2 + \dots + c_nx_n$$

subject to

$$g_1(x) = a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n \le b_1$$

$$g_2(x) = a_{21}x_1 + a_{22}x_2 + \dots a_{2n}x_n \le b_2$$

- - - - -

$$g_m(x) = a_{m1}x_1 + a_{m2}x_2 + \dots a_{mn}x_n \le b_m$$

$$x_1, x_2, \dots, x_n \ge 0$$

Components of the standard form

* Decision Variables : $x_1, x_2, \dots, x_n$
* Objective function : $z = c_1x_1 + c_2x_2 + \dots + c_nx_n$
* Constraints : $g_1(x), g_2(x), \dots g_m(x)$
* Right-Hand Side (RHS) values : $b_1, b_2, \dots b_m$
* Non-Negativity Constrains : $x_1, x_2, \dots x_n \ge 0$

Types of LP problems

* Maximization problem: Maximize the objective function.
* Minimization problem: Minimize the objective function.

Importance of Standard form

* Easier to solve: Standard form makes it easier to solve LP problems using methods like the Simplex Algorithm.
* Unified Framework: Standard form provides a unified framework for representing and solving LP problems.
* Clearer Representation: Standard form clearly reprents the decision variables, objective function, & constrains.

Simplex Algorithm

Step-by step to the Simplex Algorithm

Step-1: convert to Standard form
convert the linear programming problem (LPP) to Standard form.

Step 2: Create initial Simplex Tableau
create initial Simplex tableau.

Step 3: Choose pivot Element
choose the pivot Element.

Step 4: perform pivot operation
Perform the pivot operation.

Step-5: check optimality
check the current Solution is optimal

Step 6: Repeat steps 3-5
Repeat steps 3-5 until an optimal sol^n is reached

Step 7: Read Solution.
Read the solution from the final simplex tableau.

Simplex Algorithm pseudocode

1. Initialize the Simplex tableau.
2. while (not optimal) {
    a. choose pivot element.
    b. perform pivot operation
    c. Check optimality.
3. Read Solution from final Simplex tablea

minimize $z = 2x_1 + 3x_2 + 6x_3$ is subjected to $3x_1 - x_2 + 2x_3 \le$
$2x_1 + 4x_2 \ge -12$, $-4x_1 + 3x_2 + 8x_3 \le 10$, $x_1, x_2, x_3 \ge 0$

Given obj function $z = 2x_1 - 3x_2 + 6x_3$

Constrains: $3x_1 - x_2 + 2x_3 \le 7$

$2x_1 + 4x_2 \ge -12$

$-4x_1 + 3x_2 + 8x_3 \le 10$

Converting inequalities into equalities by add slag variables.

$3x_1 - x_2 + 2x_3 + S_1 = 7$

$-2x_1 - 4x_2 + S_2 = 12$

$-4x_1 + 3x_2 + 8x_3 + S_3 = 10$

obj function $(z) = -2x_1 + 3x_2 + 6x_3 + 0S_1 + 0S_2 + 0S_3$

	c_j	-2	3	-6	0	0	0		
c_b	bv	x_1	x_2	x_3	S_1	S_2	S_3	x_b	ratio
0	S_1	3	-1	2	1	0	0	7	= -7
0	S_2	-2	-4	0	0	1	0	12	= -3
0	S_3	-4	3	8	0	0	1	10	= 10/3 ← max
	z_j =	0	0	0	0	0	0		
	$z_j - c_j$ =	2	-3	6	0	0	0		

≥ 0 ↑ min

Eliminating S_3 and in that place we replace. NKE equation.

$$NKE = \frac{-4 \quad 3 \quad 8 \quad 0 \quad 0 \quad 1 \quad 10}{3} = \frac{-4}{3} \quad 1 \quad \frac{8}{3} \quad 0 \quad 0 \quad 1/3 \quad \frac{10}{3}$$

New S_1 = old S_1 - corres. NKE

old S_1 = 3 -1 2 1 0 0 7

c. NKE = $4/3$ -1 $-\frac{8}{3}$ 0 0 $-1/3$ $\frac{-10}{3}$

$5/3$ 0 $\frac{14}{3}$ 1 0 $1/3$ $31/3$

New s_2 = old s_2 − Corr. NKE

old s_2 = $-2 \quad -4 \quad 0 \quad 0 \quad 1 \quad 0 \quad 12$

Corr. NKE : $\frac{16}{3} \quad -4 \quad \frac{-32}{3} \quad 0 \quad 0 \quad \frac{-4}{3} \quad \frac{-40}{3}$

New s_2 : $\frac{-22}{3} \quad 0 \quad \frac{32}{3} \quad 0 \quad 1 \quad \frac{4}{3} \quad \frac{76}{3}$

II^nd Iteration

	c_j	-2	3	-6	0	0	0		
C_b	bv	x_1	x_2	x_3	s_1	s_2	s_3	x_b	ratio.
0	s_1	$\frac{5}{3}$	0	$\frac{14}{3}$	1	0	$\frac{1}{3}$	$\frac{31}{3}$	$= \frac{31}{5} \leftarrow$ max
0	s_2	$\frac{-22}{3}$	0	$\frac{32}{3}$	0	1	$\frac{4}{3}$	$\frac{76}{3}$	$= \frac{-76}{22}$
3	x_2	$\frac{-4}{3}$	1	$\frac{8}{3}$	0	0	$\frac{1}{3}$	$\frac{10}{3}$	$= -\frac{10}{4}$
	z_j =	-4	3	8	0	0	1		
	$z_j - c_j$ =	-2	0	14	0	0	1		
		↑ min							

Eleminating s_1 in that place we replace NKE Equation

$$NKE = \frac{\frac{5}{3} \quad 0 \quad \frac{14}{3} \quad 1 \quad 0 \quad \frac{1}{3} \quad \frac{31}{3}}{\frac{5}{3}} = 1 \quad 0 \quad \frac{14}{5} \quad \frac{3}{5} \quad 0 \quad \frac{1}{5} \quad \frac{31}{5}$$

New s_2 = old s_2 − corres. s_2

old s_2 = $\frac{-22}{3} \quad 0 \quad \frac{32}{3} \quad 0 \quad 1 \quad \frac{4}{3} \quad \frac{76}{3}$

cor. NKE = $\frac{-22}{3} \quad 0 \quad \frac{-308}{15} \quad \frac{-22}{5} \quad 0 \quad \frac{-22}{15} \quad \frac{682}{15}$

$0 \quad 0 \quad \frac{468}{15} \quad \frac{12}{5} \quad 1 \quad \frac{42}{15} \quad \frac{1062}{15}$

New x_1 = old s_1 - Corres. s_1

old x_1 : $-4/3$ 1 $8/3$ 0 0 $1/3$ $10/3$

Corr. NRE : $-4/3$ 0 $-\frac{96}{15}$ $-4/5$ 0 $-9/5$ $-\frac{124}{15}$

New x_2 : 0 1 $\frac{96}{15}$ $4/5$ 0 $9/5$ $174/15$

	c_j	-2	3	-6	0	0	0		
C_B	bv	x_1	x_2	x_3	S_1	S_2	S_3	x_B	ratio
-2	x_1	1	0	$14/5$	$3/5$	0	$1/5$	$3/5$	
0	S_2	0	0	$\frac{468}{15}$	$\frac{12}{5}$	1	$\frac{42}{15}$	$\frac{1062}{15}$	
3	x_2	0	1	$\frac{96}{15}$	$4/5$	0	$9/5$		

z_j : -2 3 $\frac{204}{15}$ $6/5$ 0 $21/15$

$z_j - c_j$ = 0 0 $\frac{204}{15}$ $6/5$ 0 $21/15$

$z_j - c_j \geq 0$

These values Satisfying the minimum Condition.