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Subject name: Operations Research
Dept: CSE Course: B.Tech
Registration No. - 2105 of 2021-2022
Year - 4th Sem - 8th

Assignments

Date-2/5/25

(1) Solve the following linear Programming Problem graphically.

maximize: $z = 5x + 7y$

Subject to: $x + y \leq 4$ — (I)

$3x + 8y \leq 24$ — (II)

$10x + 7y \leq 35$ — (III) $x, y \geq 0$

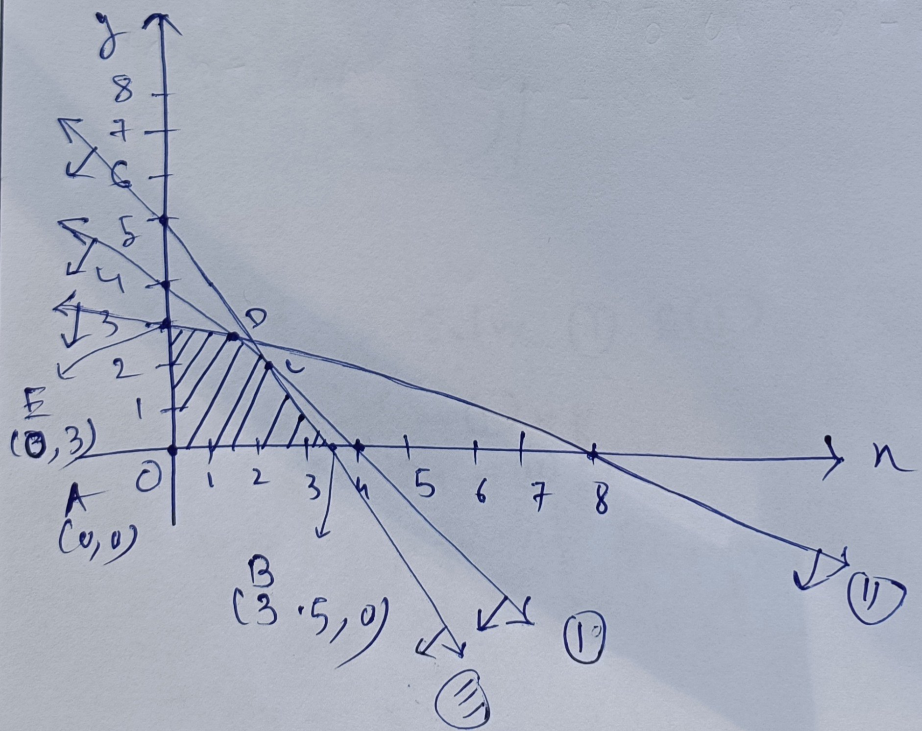
Sol^n Replacing all the inequalities by equality.

From (I), $\frac{x}{4} + \frac{y}{4} \leq 1$ $(4,0)$ & $(0,4)$

From (II), $\frac{x}{8} + \frac{y}{3} \leq$ $(8,0)$ & $(0,3)$

From (III), $\frac{x}{3.5} + \frac{y}{5} \leq 1$ $(3.5,0)$ & $(0,5)$

Plot each eqn on the graph



So, feasible region is given by ABCDE

We know, $\boxed{A = (0, 0)}$

$\boxed{B = (3.5, 0)}$

$\boxed{E = (0, 3)}$

For C,

We need to solve (I) & (III)

$x + y = 4 \quad - (I) \times 7$

$10x + 7y = 35 \quad - (II) \times 1$

$7x + 7y = 28$

$\underline{\overset{-}{10x} + \overset{-}{\cancel{7y}} = \overset{-}{35}}$

$\Rightarrow \cancel{-}3x = \cancel{-}7$

$\Rightarrow x = \frac{7}{3}$

from (I), $\frac{7}{3} + y = 4$

$\Rightarrow y = 4 - \frac{7}{3}$

$= \frac{5}{3}$

$\therefore \boxed{C = \left(\frac{7}{3}, \frac{5}{3}\right)}$

For D,

We need to solve (I) & (II)

$x + y = 4 \quad - (I) \times 8$

$3x + 8y = 24 \quad - (II) \times 1$

$8x + 8y = 32$

$\underline{\overset{-}{3x} + \overset{-}{\cancel{8y}} = \overset{-}{24}}$

$\Rightarrow 5x = 8$

$\Rightarrow x = \frac{8}{5}$

$\frac{8}{5} + y = 4$

$\Rightarrow y = 4 - \frac{8}{5}$

$= \frac{12}{5}$

$\therefore \boxed{D = \left(\frac{8}{5}, \frac{12}{5}\right)}$

Common points		Value of $Z = 5x + 7y$
$A\ (0, 0)$	$\longrightarrow$	$Z = 0$
$B\ (3.5, 0)$	$\longrightarrow$	$Z = 5 * 3.5 = 17.5$
$C\ (\frac{7}{3}, \frac{5}{3})$	$\longrightarrow$	$Z = 5 * \frac{7}{3} + 7 * \frac{5}{3} = 23.33$
$D\ (\frac{8}{5}, \frac{12}{5})$	$\longrightarrow$	$Z = 5 * \frac{8}{5} + 7 * \frac{12}{5} = 24.8$ (max val)
$E\ (0, 3)$	$\longrightarrow$	$Z = 7 * 3 = 21$

$\therefore$ The max val. of Z is obtained at point $D = (\frac{8}{5}, \frac{12}{5})$ & the val. is 24.8.

$\therefore$ The optimal soln is $x = \frac{8}{5} = 1.6$, $y = \frac{12}{5} = 2.4$.

② Obtain the initial basic feasible solution for the following transportation problem using the 'Least Cost method'.

		Destination			
		A	B	C	Supply
Source	1	2	7	4	5
	2	3	3	1	8
	3	5	4	7	7
	4	1	6	2	14
	Demand	7	9	18	34

Sol^n

since $\Sigma a_i = \Sigma b_j = 34$, there exists a feasible (balanced) sol^n to the transportation problem

we obtain the initial feasible sol^ns as follows:

The given t.p. is stated in the following table.

Desti-nation / Source	A	B	C	Supply
O_1	2	(2) 7	(3) 4	~~5~~ ~~2~~
O_2	3	3	(8) 1	~~8~~ 0
O_3	5	(7) 4	7	~~7~~ 0
O_4	(7) 1	6	(7) 2	~~14~~ ~~7~~ 0
Demand	~~7~~ 0	~~9~~ ~~2~~ 0	~~18~~ ~~10~~ ~~3~~ 0	

Hence we get the initial basic feasible sol^n to the given t.p. which is given by

$x_{12} = 2$, $x_{23} = 8$, $x_{32} = 7$, $x_{41} = 7$, $x_{43} = 7$, $x_{13} = 3$

$\therefore$ Total cost (min) $= 2*7 + 3*4 + 8*1 + 4+7 + 7*1 + 7*2$

$= 83$

Allocated cells = 6

$m+n-1 = 4+3-1 = 6$ & also it is forming no

close paths, i.e cells are independent.
& the soln is non-degenerate.