2017

(1)

Objective function: Maximize $2x+y$

subject to constraint

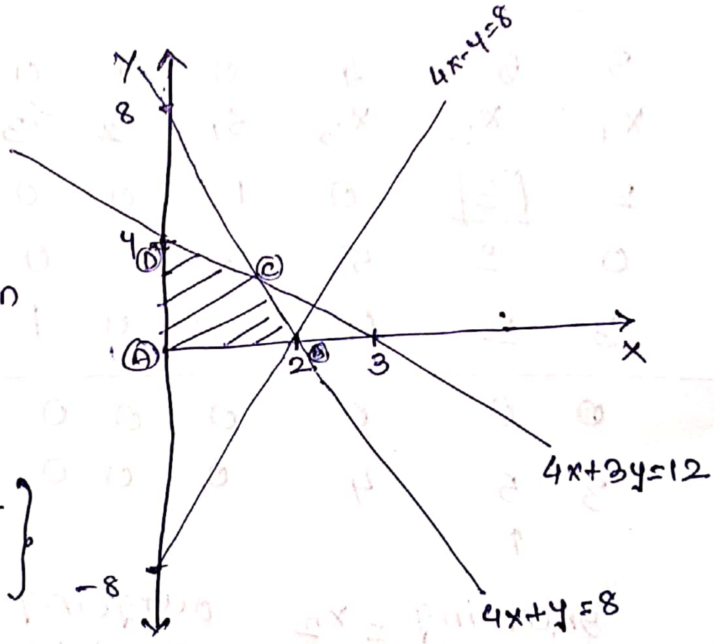
$$4x+3y \le 12$$
$$4x+y \le 8$$
$$4x-y \le 8$$
$$x, y \ge 0$$

Plotting all these constraint on graph

Point C is intersection of $4x+y=8$

$4x+3y=12$

$\rightarrow$ $2y=4$ $\left\{ \begin{matrix} y=2 \\ x=1.5 \end{matrix} \right\}$



Shaded portion represents feasible region satisfying constraint

	corner points	$z=2x+y$
A →	(0,0)	0
B →	(2,0)	4
C →	(1.5,2)	$\boxed{5}$
D →	(0,4)	4

maximum value of $z=5$ at $(1.5, 2)$

(2) Rewriting constraint equation and objective function by adding slack variable. we have

Constraint equation

$$2x_1 + 3x_2 + s_1 = 8$$
$$2x_2 + 5x_3 + s_2 = 10$$
$$3x_1 + 2x_2 + 4x_3 + s_3 = 15$$

Objective function:

$$\cancel{\text{Max}} \quad z = 3x_1 + 5x_2 + 4x_3 + 0s_1 + 0s_2 + 0s_3$$

Rewriting these in simplex table,

	C_j	3	5	4	0	0	0		
C_B	basis	x_1	x_2	x_3	s_1	s_2	s_3	solution	ratio
0	s_1	2	$\boxed{3}$	0	1	0	0	8	8/3 ←
0	s_2	0	2	5	0	1	0	10	5
0	s_3	3	2	4	0	0	1	15	15/2
	z_j	0	0	0	0	0	0		
	$c_j - z_j$	3	5 ↑	4	0	0	0		

key element = 3 Incoming variable = x_2 outgoing variable = s_1

~~0~~5	x_2	2/3	1	0	1/3	0	0	8/3	
0	s_2	-4/3	0	$\boxed{5}$	-2/3	1	0	14/3	14/15 ←
0	s_3	5/3	0	4	-2/3	0	1	29/3	29/12
	z_j	10/3	5	0	5/3	0	0		
	$c_j - z_j$	-1/3	0	4 ↑	-1/3	0	0		

Key element = 5 Incoming variable = x_3 outgoing variable = s_2

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5	x_2	2/3	1	0	1/3	0	0	8/3	4
4	x_3	-4/15	0	1	-2/15	1/5	0	14/15	-
0	s_3	$\boxed{41/15}$	0	0	-2/15	-4/5	1	89/15	89/41 ←
	z_j	34/15	5	4	11/5	4/15	0	256/15	
	$c_j - z_j$	+11/15 ↑	0	0	-11/5	-4/15	0		

Key element = 41/15 incoming variable = x_1 outgoing variable = s_3

5	x_2	0	1	0	15/45	8/15	-2/3	+50/41
4	x_3	0	0	1	-38/225	5/41	4/41	62/41
3	x_1	1	0	0	-2/41	-12/41	15/41	89/41
	z_j	3	5	4	+1.289	+2.276	.268	765/41
	$c_j - z_j$	0	0	0	-1.289	-2.276	-.268	

all $c_j - z_j \leq 0$

optimal solution

$x_1 = 89/41$, $x_2 = 50/41$, $x_3 = 62/41$

maximum value of $z = 765/41$

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(9)

	D_1	D_2	D_3	D_4	D_5	Supply	Penalty
O_1	4 [6]	7 [0]	0 [0]	3 [0]	6 [8]	14	3, 1, 1, 2, 2, 2
O_2	1 [1]	2 [0]	-3 [8]	3 [0]	8 [0]	9	4, 1, 2, 7, -, -
O_3	3 [1]	-1 [3]	4 [0]	0 [13]	5 [0]	17	1, 1, 3, 2, 2, 2
Demand	8	3	8	13	8		

Penalty				
2	3	3	3	1
2	3	-	3	1
2	-	-	3	1
2	-	-	-	1
1	-	-	-	1

Σ supply = Σ balanced = 40

Above is Vogel's table in which we took penalty ~~in~~ each time. The one having highest penalty and lowest cost is alloted. So as per table,

IBFS of given problem:

(6, 0, 0, 0, 8, 1, 0, 8, 0, 0, 1, 3, 0, 13, 10)

Transportation cost

$= 4\times6 + 6\times8 + 1\times1 - 3\times8 + 3\times1 - 3\times1 + 0\times13$

$= \underline{49}$