SOMAIYA VIDYAVIHAR UNIVERSITY

Batch: _____ Roll No.: _____
Name : _____
Course : _____
Experiment / assignment / tutorial No. _____
Grade: _____ Signature of the Faculty with date

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Batch - B2.

CO4 - IA 2

Q1) Find (i) All basic solution (ii) All feasible solution iii) All degenerate solution. Deide the optimal feasible solution for the following L.P.P.

$$\min z = 2x_1 + 3x_2 + x_3 + x_4$$

subject to
$$x_1 + 2x_2 - x_3 + x_4 = 5$$
$$2x_1 + x_2 + 2x_3 - 2x_4 = 3$$

where ~~$x_1 + 2x_2 + x_3 + x_4 = 5$~~
~~$2x_1 + x_2 + 2x_3 - 2x_4 = 3$~~

Where $x_1, x_2, x_3, x_4 \geq 0$

Here $m = 2$ (No. of eq.), $n = 4$ (no. of var.)

No. of basic solution = $^4C_2 = 6$.

No. of Basic sol. Non basic sol. Basic var. eq.

No. of basic sol.	Non basic sol.	Basic var	eqn & val. of basic var	BFS	Deg	value of op 2	
1.	$x_3 = 0$ $x_4 = 0$	x_1 x_2	$x_1 + 2x_2 = 5$ $2x_1 + x_2 = 3$ } $x_1 = 1/3$, $x_2 = 7/3$	Yes	Non Deg	7.6	No
2.	$x_2 = 0$ $x_4 = 0$	x_1 x_3	$x_1 + x_3 = 5$ $2x_1 + 2x_3 = 3$ } $x_1 = 1/3$, $x_2 = 7/3$	No	—	—	—
3.	$x_1 = 0$ $x_2 = 0$	x_2 x_3	$2x_1 - x_3 = 5$ $x_2 + 2x_3 = 3$ } $x_2 = 26$, x_3 ?	Yes	Non Deg	&	No
4.	$x_2 = 0$ $x_3 = 0$	x_1 x_4	$x_1 + x_4 = 5$ $2x_1 - 2x_4 = 3$ } $x_1 = 3.25$, $x_4 = 1.75$	Yes	Non Deg	8.25	*
5.	$x_1 = 0$ $x_3 = 0$	x_2 x_4	$2x_2 + x_4 = 5$ $x_2 - 2x_4 = 3$ } $x_2 = 2.6$, $x_4 = 0.2$	No	—	—	?
6.	$x_1 = 0$ $x_2 = 0$	x_3 x_4	$-x_3 + x_4 = 5$ $2x_3 - 2x_4 = 3$ } NO sol.	=	+	−	=

$x_1 = 1/3$, $x_2 = 7/3$, $x_3 = x_4 = 0$
$x_1 = 3.25$, $x_3 = 1.75$, $x_2 = x_4 = 0$
$x_2 = 2.6$, $x_3 = 0.2$, $x_1 = x_4 = 0$
$x_4 = 3.75$, $x_4 = 1.75$, $x_2 = x_3 = 0$,
$x_2 = 2.6$, $x_4 = -0.2$ $x_1 = x_3 = 0$
$x_1 = x_2 = 0$, $x_3 = x_4$ → No sol.

There are basic soln.

ii) Feasible basic soln. are
$x_1 = 1/3$, $x_2 = 7/3$, $x_3 = x_4 = 0$
$x_2 = 2.6$, $x_3 = 0.2$, $x_1 = x_4 = 0$
$x_1 = 3.25$, $x_4 = 1.75$, $x_2 = x_3 = 0$

iii) There are no degenerate sol.

iv) optimal feasible soln basic is 2 - 8.25
$x_1 = 3.25$, $x_2 = 1.75$, $x_2 = x_3 = 0$.

Q2. Convert the given L.P.P into standard form

Min $Z = 7x_1 - 48x_2 + 23x_3$

subject to

$$61x_1 - 24x_2 + 12x_3 \leq 91$$
$$3x_1 - 61x_2 + 81x_3 \geq 9$$
$$x_1 - 33x_2 + 53x_3 \leq -5$$

Where $x_1, x_2 \geq 0$ & x_3 is unrestricted in sign

Minimize $Z = -7x_1 + 48x_2 - 23x_3$

Constraint

Solution -

$x_1 - 33x_2 + 53x_3 \leq -5 \times (-1) \Rightarrow \geq 5$

$x_1, x_2 \geq 0$; x_3 is unrestricted

Thus while observing the problem we notice that x_2 is unrestricted

$$-x_1 + 33x_2 - 53x_3 \geq 5$$

$$61x_1 - 24x_2 + 12(x_3' - x_3'') + s_1 + 0s_2 + 0s_3 = 91$$
$$3x_1 - 61x_2 + 81(x_3' - x_3'') + 0s_1 + s_2 + 0s_3 = 9$$
$$-x_1 + 33x_2 - 53(x_3' - x_3'') + 0s_1 + 0s_2 + s_3 = 5$$

$$Z = -7x_1 + 48x_2 - 23(x_3' - x_3'') + 0s_1 + 0s_2 + 0s_3$$

$$x_1, x_2, x_3', x_3'', s_1, s_2, s_3 \geq 0.$$

[Standard Form]

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Q3) Solve the given L.P.P by simplex method

Maximize $Z = 3x_1 + 5x_2 + 4x_3$
Subject to
$2x_1 + 3x_2 \leq 8$
$2x_2 + 5x_3 \leq 10$
$3x_1 + 2x_2 + 4x_3 \leq 15$
where $x_1, x_2, x_3 \geq 0$

→ We first express in standard form.

$Z - 3x_1 - 5x_2 + 4x_3 + 0s_1 + 0s_2 + 0s_3 = 0$
$2x_1 + 3x_2 + 0x_3 + s_1 + 0s_2 + 0s_3 = 8$
$0x_1 + 2x_2 + 5x_3 + 0s_1 + s_2 + 0s_3 = 10$
$3x_1 + 2x_2 + 4x_3 + 0s_1 + 0s_2 + 8s_3 = 15$

It. NO	Basic var.	Coeff						R.HS Sol.	
0	S_1 extra	x_1	x_2	x_3	S_1	S_2	S_3		
R_0	Z	-3	-8	-4	0	0	0	0	
R_1	S_1	2	3	0	1	0	0	8	
R_2	S_2	0	2	5	0	1	0	10	
R_3	S_3	3	2	4	0	0	1	18	
1	S_3 leave, x_1 enter	x_1	x_2	x_3	S_1	S_2	S_3		
$R_0' = R_0 + 3R_2$	Z	1/3	0	-4	5/3	0	0	40/3	
$R_1' = R_1/3$	x_2	2/3	1	0	1/3	0	0	8/3	
$R_2' = R_2 - 2R_1$	S_2	-4/3	0	5	-2/3	1	0	14/3	
$R_3' = R_3 - 2R_1$	S_3	5/3	0	4	2/3	0	1	29/3	
2	S_2 leave, x_2 enter	x_1	x_2	x_3	S_1	S_2	S_3		
$R_0' = R_0 + 4R_2'$	Z	-11/15	0	0	13/15	4/3	0	256/15	
$R'' = R_1$	x_2	2/3	1	0	1/3	0	0	8/3	
$R_2'' = R_2/5$	x_3	-4/15	0	1	-2/15	1/5	0	14/15	
$R_3'' = R_3 - 4R_2$	S_3	41/15	0	0	-2/15	-4/5	1	9/15	
3	S_3 leave, x_3 enter	x_1	x_2	x_3	S_1	S_2	S_3		
$R_0' = R_0 + 11/4 R_3$	Z	0	0	0	45/41	24/41	11/41	760/41	
$R_1 - 2/3 R_3$	x_2	0	1	0	16/41	8/41	-10/41	80/41	
$R_2 + 4/15 R_3$	x_3	0	0	1	-6/41	5/41	4/41	62/41	
$R_3' = (15/4) R_3$	x_1	1	0	0	-2/41	-12/41	15/41	89/41	

$x_1 = 89/41$

$x_2 = 80/41$

$x_3 = 62/41$

$Z_{max} = 785/41$.