Somaiya TRUST

Batch: B2 Roll No.: 16010421116
Experiment / assignment / tutorial No. _____
Grade: AA/ AB / BB / BC / CC / CD / DD

Signature of the Faculty In-Charge with date

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CO4 - IA-2

Q1 Find (i) All basic solutions (ii) All feasible solutions (iii) All Degenerate solutions hence ~~dedo~~ decide the optimal feasible basic for the following L.P.P.

maximize $z = 2x_1 + 3x_2 + x_3 + x_4$

Subject to $x_1 + 2x_2 - x_3 + x_4 = 5$

$2x_1 + x_2 + 2x_3 - 2x_4 = 3$

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

→ Here $m = 2$ (No. of eq) & $n = 4$ (No. of variable)

no. of basic ~~solo~~ solutions $= {}^nC_m = {}^4C_2 = 6$

To get basic feasible solution we put $n - m$ Variable $= 0$

No. of basic sol.	Non basic variable	Basic variable	Eqn. & value of basic variable	BFS	Deg	Value of z	optimal sol
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	$x_1 - x_3 = 5$, $2x_1 + 2x_3 = 3$ ⇒ $x_1 = 3.25$, $x_2 = -1.75$	Non	—	—	—
3	$x_1 = 0$, $x_2 = 0$	x_2, x_3	$2x_2 - x_3 = 5$, $x_2 + 2x_3 = 3$ ⇒ $x_2 = 2.6$, $x_3 = 0.2$	Yes	Non Deg	8	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	Yes
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 solution	—	—	—	—

i) $x_1 = 1/3$, $x_2 = 7/3$, $x_3 = x_4 = 0$

$x_1 = 3.25$, $x_2 = 1.75$, $x_2 = x_4 = 0$

$x_2 = 2.6$, $x_3 = 0.2$, $x_1 = x_4 = 0$

$x_1 = 3.25$, $x_4 = 1.75$, $x_2 = x_3 = 0$

$x_2 = 2.6$, $x_4 = -0.2$, $x_1 = x_3 = 0$

$x_1 = x_2 = 0$, $x_3 = x_4 \rightarrow$ No solution. There are basic Solution

ii) Feasible basic solution 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 Solution

iv) Optimal feasible basic is $Z = 8.25$

$x_1 = 3.25$, $x_2 = 1.75$, $x_2 = x_3 = 0$

Q2 Convert the given LPP into standard form

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

Subject to $x_1 + 2x_2 - x_3 + x_4 = 5$

$2x_1 + x_2 + 2x_3 - 2x_4 = 3$

where x_i

minimize $z = 7x_1 - 48x_2 + 23x_3$

Subject to

$61x_1 - 29x_2 + 12x_3 \leq 93$

$3x_1 - 61x_2 + 81x_3 \geq 9$

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

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

→ Maximize $Z = -7x_1 + 48x_2 - 23x_3$

(constraints)

$61x_1 - 29x_2 + 12x_3 \leq 93$

$3x_1 - 61x_2 + 81x_3 \geq 9$

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

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

Then, while observing the problem we notice that x_2 is unrestricted.

$x_1, x_2, x_3 = x_3' - x_3''$

where $x_1, x_2, x_3', x_3'' \geq 0$

Such that

→ $-x_1 + 33x_2 - 53x_3 \geq 5$

$61x_1 - 29x_2 + 12(x_3' - x_3'') + s_1 + 0s_2 + 0s_3 = 93$

$3x_1 - 61x_2 + 81(x_3' - x_3'') + 0s_1 - s_2 + 0s_3 = 9$

$-x_1 + 33x_2 - 53(x_3' - x_3'') + 0s_1 + 0s_2 + s_3 = +5$

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

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

[Standard form]

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Q3 Solve the given LPP by Simplex method

minimize $Z = 3x_1 + 5x_2 + 4x_3$

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 the given problem in standard form

$Z - 3x_1 - 5x_2 + 4x_3 + 0S_1 + 0S_2 + 0S_3 = 0$

$2x_1 + 3x_2 + 0x_3 + S_1 + 0S_2 + 0S_3 = 8$

$0x_1 + 2x_2 + 5x_3 + 0S_1 + 1S_2 + 0S_3 = 10$

$3x_1 + 2x_2 + 4x_3 + 0S_1 + 0S_2 + S_3 = 15$

We put this information in tabular form as follows.

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Iteration number	Basic Variable	Coefficients						RHS Solution	Ratios
		x_1	x_2	x_3	S_1	S_2	S_3		
0	S_1 leaves, x_1 enters								
R_0	Z	-3	-5	-4	0	0	0	0	
R_1	S_1	2	3*	0	1	0	0	8	8/3 = 2.67
R_2	S_2	0	2	5	0	1	0	10	10/2 = 5
R_3	S_3	3	2	4	0	0	1	15	15/2 = 7.5
1	S_2 leaves, x_2 enters	x_1	x_2	x_3	S_1	S_2	S_3		
$R_0' = R_0 + 5R_1'$	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	14/15
$R_3' = R_3 - 2R_1'$	S_3	5/3	0	4	-2/3	0	1	29/3	29/12
2	S_3 leaves, x_3 enters	x_1	x_2	x_3	S_1	S_2	S_3		
$R_0'' = R_0 + 4R_2'$	Z	-11/15	0	0	17/15	4/5	0	256/15	
$R_1'' = R_1$	x_2	2/3	1	0	1/3	0	0	8/3	4
$R_2'' = R_2/5$	x_3	-4/15	0	1	-2/15	1/5	0	14/15	—
$R_3'' = R_3 - 4R_2'$	S_3	11/15	0	0	-2/15	-4/5	1	89/15	89/41
3		x_1	x_2	x_3	S_1	S_2	S_3		
$R_0 + 11/15 R_3''$	Z	0	0	0	45/41	24/41	11/41	765/41	
$R_1 - 2/3 R_3''$	x_2	0	1	0	15/41	8/41	-10/41	50/41	
$R_2 + 4/15 R_3''$	x_3	0	0	1	-6/41	5/41	4/41	62/41	
$R_3' = (15/41) R_3''$	x_1	1	0	0	-2/41	-12/41	15/41	89/41	

$\therefore x_1 = 89/41$

$x_2 = 50/41$

$x_3 = 62/41$

$Z_{max} = 765/41$