

Subject: Applied Mathematics IV

SEM:IV

Dual Simplex Method

Working Procedure :-

- * Convert the problem into **minimisation type**.
- * Convert all constraints in **less than or equal to type**.
If any constraint is of greater than or equal to type multiply by '-1' & change the inequality sign
- * Form the simplex table
- * In the RHS soln column select the row which contains the smallest (negative) number. This is the key row & the corresponding variable is the outgoing variable
- * Now find the ratios by dividing the Z row by the key row & write these Ratios in another row below the table.



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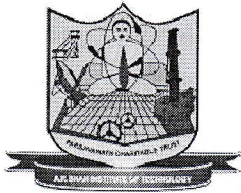
* Now the smallest ratio and the corresponding column is key column & the corresponding variable is the incoming variable.

* If all the w -efficients in the row of z are negative and all the right hand side constants w b's are positive then basic feasible solution is obtained.

If all the w -efficients in the row of z are negative and atleast one of the right hand side constants is negative, then continue the process.

① Use the dual simplex method to solve the following LPP.

$$\begin{aligned} \text{Minimise} \quad & Z = 2x_1 + 3x_2 + 4x_3 \\ \text{Subject to} \quad & 2x_1 + 3x_2 + 5x_3 \geq 2 \\ & 3x_1 + x_2 + 7x_3 \leq 3 \\ & x_1 + 4x_2 + 6x_3 \leq 5 \\ & x_1, x_2, x_3 \geq 0. \end{aligned}$$



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Soln:-

Minimise $Z = 2x_1 + 2x_2 + 4x_3 + 0s_1 + 0s_2 + 0s_3$

$Z - 2x_1 - 2x_2 - 4x_3 - 0s_1 - 0s_2 - 0s_3$

subject to $-(2x_1 + 3x_2 + 5x_3) + s_1 + 0s_2 + 0s_3 = -2$

(i) $-2x_1 - 3x_2 - 5x_3 + s_1 + 0s_2 + 0s_3 = -2$

$3x_1 + x_2 + 7x_3 + 0s_1 + s_2 + 0s_3 = 3$

$x_1 + 4x_2 + 6x_3 + 0s_1 + 0s_2 + s_3 = 5$

Simplex table

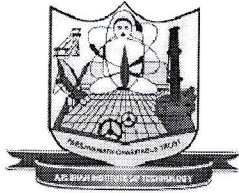
Iteration number	Basic Variables	co-effts of						RHS solution
		x_1	x_2	x_3	s_1	s_2	s_3	

0	Z	-2	-2	-4	0	0	0	0
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	s_1 leaves s_1 enters	-2	-3*	-5	1	0	0	-2	←
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	s_2	3	1	7	0	1	0	3
	s_3	1	4	6	0	0	1	5

Ratio	-2/-2	-2/-3	-4/-5	-	-	-	-
	= 1	= 2/3	= 4/5				
		↑					



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$$\begin{array}{cccccccc} 1 & Z & -2/3 & 0 & -2/3 & -2/3 & 0 & 0 & 4/3 \\ x_2 & 2/3 & 1 & 5/3 & -1/3 & 0 & 0 & 0 & 2/3 \\ s_2 & 7/3 & 0 & 16/3 & 1/3 & 1 & 0 & 0 & 7/3 \\ s_3 & -5/3 & 0 & -2/3 & 4/3 & 0 & 1 & 0 & 7/3 \end{array}$$

$$\therefore x_1 = 0$$

$$x_2 = 2/3$$

$$x_3 = 0$$

$$Z_{\min} = 4/3$$

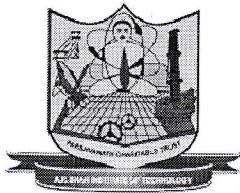
② Use the dual simplex method to solve the following LPP

$$\text{Minimise } Z = x_1 + x_2$$

$$\text{subject to } 2x_1 + x_2 \geq 2$$

$$-x_1 - x_2 \geq 1$$

$$x_1, x_2 \geq 0$$



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Soln:-

Minimise $Z = 2x_1 + 2x_2 + 4x_3 + 0s_1 + 0s_2 + 0s_3$

$Z - 2x_1 - 2x_2 - 4x_3 - 0s_1 - 0s_2 - 0s_3$

subject to $-(2x_1 + 3x_2 + 5x_3) + s_1 + 0s_2 + 0s_3 = -2$

(i) $-2x_1 - 3x_2 - 5x_3 + s_1 + 0s_2 + 0s_3 = -2$

$3x_1 + x_2 + 7x_3 + 2s_1 + s_2 + 0s_3 = 3$

$x_1 + 4x_2 + 6x_3 + 0s_1 + 0s_2 + s_3 = 5$

Simplex table

Iteration number	Basic Variables	co-effts of						RHS solution
		x_1	x_2	x_3	s_1	s_2	s_3	

0	Z	-2	-2	-4	0	0	0	0
---	---	----	----	----	---	---	---	---

	s ₁	-2	-3*	-5	1	0	0	-2
--	----------------	----	-----	----	---	---	---	----

s₁ leaves

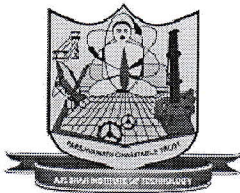
x₂ enters

	s ₂	3	1	7	0	1	0	3
	s ₃	1	4	6	0	0	1	5

Ratio

-2/-2	-2/-3	-4/-5	-	-	-
= 1	= 2/3	= 4/5			





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Soln:-

Minimise

$$Z = x_1 + x_2 + 0s_1 + 0s_2$$

$$Z - x_1 - x_2 - 0s_1 - 0s_2 = 0$$

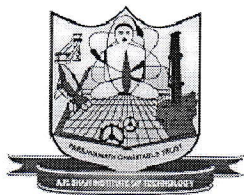
subject to $-2x_1 - x_2 + s_1 + 0s_2 = -2$

$$x_1 + x_2 + 0s_1 + s_2 = -1$$

Simplex table

Iteration no	Basic Variables	co-effts		y_j		RHS Solution
		x_1	x_2	s_1	s_2	
0	Z	-1	-1	0	0	0
	s_1	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> -2^* -1 1 0 -2 </div>				←
	s_2	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 1 1 0 1 -1 </div>				
Ratio		$1/2$	1			
		\uparrow				

1	Z	0	$-1/2$	$-1/2$	0	1
	x_1	1	$1/2$	$-1/2$	0	1
	s_2	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 0 $1/2$ $1/2$ 1 -2 </div>				←
Ratio		-	-1	-1	-	



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Since all the ratios are negative, the given LPP has no feasible solution.

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