

15/ENG02/005

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COE512 Assignment 2.

1. let  $d_i =$  demand for the month  
 $z_i =$  no of workers during the month  
 $z_0 = 30$   
 $x_i =$  no of carpets made during the month  
 $y_i =$  no of carpets made overtime in month  $i$

$h_i, f_i =$  workers hired / fired respectively at the beginning of the

$s_i =$  no of carpets stored

$$s_0 = 0$$

$$z_i, y_i, x_i, h_i, f_i, s_i, s_0 \geq 0$$

$$i = 1, 2, 3, \dots, 12; \quad i-1 = \text{previous month}$$

total carpets made:  $x_i = 20z_i + y_i$

estimated no of workers at the beginning of each month:

$$z_i = z_{i-1} + h_i - f_i$$

number of stored carpets:  $s_i = s_{i-1} + x_i - d_i$

limitations of overtime:

$$y_i \leq 6z_i$$

objective function - to minimize total cost:

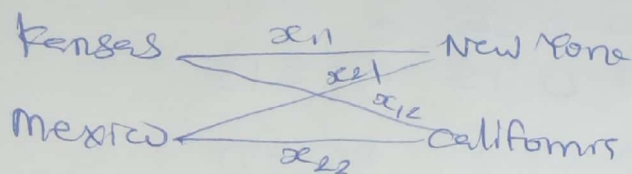
$$\Rightarrow \min 2000 \sum z_i + 320 \sum h_i + 400 \sum f_i + 3 \sum s_i + 180 \sum y_i$$

2.

	cartons
Kansas	15
Mexico	8

	bags
New York	10
California	13

	cost of shipping to	
	New York	California
Kansas	2	3
Mexico	4	1



production constraint

$$x_{11} + x_{12} \leq 15$$

$$x_{21} + x_{22} \leq 8$$

$$x_{11} + x_{21} \leq 10$$

$$x_{12} + x_{22} \leq 13$$

$$\min Z = 9_{11}x_{11} + 9_{12}x_{12} + 9_{21}x_{21} + 9_{22}x_{22}$$

$$\Rightarrow 2x_{11} + 3x_{12} + 4x_{21} + x_{22}$$

$$Z = 2x_1 + 3x_2 + 4x_3 + x_4$$

$$x_1 + x_2 + s_1 = 15$$

$$x_3 + x_4 + s_2 = 8$$

$$x_1 + x_3 + s_3 = 10$$

$$x_2 + x_4 + s_4 = 13$$

$$Z - 2x_1 - 3x_2 - 4x_3 - x_4 = 0$$

$$x_{11} = x_1$$

$$x_{12} = x_2$$

$$x_{21} = x_3$$

$$x_{22} = x_4$$

	$x_1$	$x_2$	$x_3$	$x_4$	$s_1$	$s_2$	$s_3$	$s_4$	RHS	
Z	-2	-3	-4	-1	0	0	0	0	0	0
$s_1$	1	1	0	0	1	0	0	0	15	$15/0 = 0$
$s_2$	0	0	1	1	0	1	0	0	8	$8/1 = 8$
$s_3$	1	0	1	0	0	0	1	0	10	$10/1 = 10$
$s_4$	0	1	0	1	0	0	0	1	13	$13/0 = 0$

Key column:  $x_3$ , key row:  $s_2$

	$x_1$	$x_2$	$x_3$	$x_4$	$s_1$	$s_2$	$s_3$	$s_4$	RHS	
Z	-2	-3	0	3	0	4	0	0	32	
$s_1$	1	1	0	0	1	0	0	0	15	$15/1 = 15$
$x_3$	0	0	1	1	0	1	0	0	8	$8/0 = 0$
$s_3$	1	0	0	-1	0	-1	1	0	2	$2/0 = 0$
$s_4$	0	1	0	1	0	0	0	1	13	$13/1 = 13$

Key column:  $x_2$ ; key row:  $s_4$

	$x_1$	$x_2$	$x_3$	$x_4$	$s_1$	$s_2$	$s_3$	$s_4$	RHS	
Z	-2	0	0	6	0	4	0	3	71	
$s_1$	1	0	0	-1	1	0	0	-1	2	$2/1 = 2$
$x_3$	0	0	1	1	0	1	0	0	8	$8/0 = 0$
$s_2$	1	0	0	-1	0	-1	1	0	2	$2/1 = 2$
$s_4$	0	1	0	1	0	0	0	1	13	$13/0 = 0$

Key column:  $x_1$ ; key row:  $s_1$

⇒

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	$x_1$	$x_2$	$x_3$	$x_4$	$s_1$	$s_2$	$s_3$	$s_4$	RHS
$Z$	0	0	0	4	2	4	0	1	75
$x_1$	1	0	0	-1	1	0	0	-1	2
$x_3$	0	0	1	1	0	1	0	0	8
$s_3$	0	0	0	0	-1	-1	1	1	0
$x_2$	0	1	0	1	0	0	0	1	13

⇒  $x_1 = 2$

$x_2 = 13$

$x_3 = 8$

$x_4 = 0$

minimum cost:

$Z_{\min} = 75$