15/ENG02/025 20-04-2020 (1)

Solution for no. 1

d_i = demand for the month

z_i = number of workers during i^{th} month; $z_1 = 30$

y_i = number of carpets made overtime in month 1.

x_i = number of carpets made during the i^{th} month

h_i, f_i = workers hired and fired respectively at the beginning of month;

s_i = number of stored carpet at end of i;

$s_0 = 0$

$$z_i, y_i, x_i, h_i, f_i, s_i, s_0, \geq 0 \quad i = 1, 2, 3, \ldots 12$$

Total carpets made

$$x_i = 20 z_i + y_i$$

Potential number of workers at start of each month

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

number of stored carpets;

$$s_i = s_{i-1} + x_i - d_i$$

NB: $i-1$ is the previous month.

Limitations of Overtime

$$y_i \leq 62i$$

The objective function is to minimize total cost, [redacted] Therefore,

$$\min 2000 \sum z_i + 320 \sum h_i + 400 \sum f_i + 18 \sum s_i + 180 \sum y_i$$

29 30 31 | 26 27 28 29 30 31 | 23 24 25 26 27 28 29 | 28 29 30 31 | 25 26 27 28 29 30 | 23 24 25 26 27

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Solution for No. 2

Given,

Kansas = 15 keyboards (Carton)

Mexico = 8 keyboard (Carton)

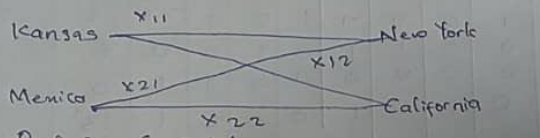
New York = 10 (Bags)

California = 13 (Bags)

	New York	California
Mexico	$4	$1
Kansas	$2	$3

~~When minimized, we have~~

~~Z = 2x11 + 4x12 + 2x21 + 3x22~~



Production Constraint

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

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

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

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

2

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

$\min Z = 2x_{11} + 3x_{12} + 4x_{21} + x_{22}$

Iter	Value	x_1	x_2	x_3	x_4	s_1	s_2	s_3	s_4	RHS	Ratio
		-2	0	0	6	0	4	0	3		
		1	0	0	-1	1	0	0	-1	2	2/1
		0	0	1	1	0	1	0	0	8	8/0
		1	0	0	-1	0	-1	1	0	2	2/1
		0	1	0	1	0	0	0	1	13	13/0

taking -2 as the most negative value, x_1 becomes our reference column and s_1 as our reference row

Iter	Basic value	x_1	x_2	x_3	x_4	s_1	s_2	s_3	s_4	RHS	Ratio
		0	0	0	4	2	4	0	1	75	
		1	0	0	-1	1	0	0	-1	2	
		0	0	1	1	0	1	0	0	8	
		0	0	0	0	-1	-1	1	1	0	
		0	1	0	1	0	0	0	1	13	

Therefore $x_1 = 2$, $x_2 = 13$

$x_3 = 8$ $x_4 = 0$

Hence the minimum cost (Z_{min}) = 75

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Adding slack element (4)

$x_{11} = x_1$, $x_{12} = x_2$, $x_{21} = x_3$, $x_{22} = x_4$

$Z = 2x_1 + 3x_2 + 4x_3 + 1x_4$

$x_1 + x_2 + s_1 = 15$

$x_3 + x_4 + s_2 = 8$

$x_1 + x_3 + s_3 = 10$

$x_2 + x_4 + s_4 = 13$

equating Z to zero we get;

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

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

Now we have -4 as the highest negative value ∴ we make x_3 our pivot

iter	Value	x_1	x_2	x_3	x_4	s_1	s_2	s_3	s_4	RHS	Ratio
1 (2+4x)	Z	-2	-3	0	3	0	4	0	0	32	
	s_1	1	1	0	0	1	0	0	0	15	15/1
	x_3	0	0	1	1	0	1	0	0	8	8/0
	s_3	1	0	0	-1	0	-1	1	0	2	2/0
	s_4	0	1	0	1	0	0	0	1	13	13/1

We have -3 as our new highest negative value, therefore we make x_2 the pivot column.