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Quiz

$d_i$  = demand for the month;  $z_i$  = no. of workers during the month;

$z_0 = 30$   $y_i$  = no. of carpets made overtime in month  $i$

$x_i$  = no. of carpets made during the  $i$ th month

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

$s_i$  = number of stored carpets stored at the end of month  $i$

$s_0 = 0$

$e_i, y_i, x_i, h_i, f_i, s_i, s_0, w \geq 0$   $i = 1, 2, 3, \dots, 12$

Total carpets made;

$$20z_i = 20z_i + y_i$$

Potential number of workers at start of each month

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

Number of stored carpets

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

where  $i-1$  = the previous month

The limitation of overtime

$$y_i \leq 6z_i$$

Objective function is to minimize total cost; Hence;

$$\min = 2000 \sum_i z_i + 320 \sum_i h_i + 400 \sum_i f_i + 8 \sum_i s_i + 180 \sum_i y_i$$



| iter Basic | $x_1$ | $x_2$ | $x_3$ | $x_4$ | $s_1$ | $s_2$ | $s_3$ | $s_4$ | 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  | $15/0 = 0$  |
| $s_2$      | 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  | $13/0 = 0$  |

Most negative value from row 1-4 hence we make  $x_3$  key column therefore for  $s_2$  over key row

| iter Basic         | $x_1$ | $x_2$ | $x_3$ | $x_4$ | $s_1$ | $s_2$ | $s_3$ | $s_4$ | RHS | Ratio       |
|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-------------|
| 1 ( $z + 4x_3$ ) 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  | $13/1 = 13$ |

Lowest value is -3  $\therefore x_2$  - key column  $\therefore s_4$  key row

| iter Basic            | $x_1$ | $x_2$ | $x_3$ | $x_4$ | $s_1$ | $s_2$ | $s_3$ | $s_4$ | RHS | Ratio      |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-----|------------|
| 2 ( $z + 3x_2$ ) Z    | -2    | 0     | 0     | 6     | 0     | 4     | 0     | 3     | 7   |            |
| ( $s_1 + x_2$ ) $s_1$ | 1     | 0     | 0     | -1    | 1     | 0     | 0     | -1    | 2   | $2/1 = 2$  |
| $x_3$                 | 0     | 0     | 1     | 1     | 0     | 1     | 0     | 0     | 8   | $8/0 = 0$  |
| $s_3$                 | 1     | 0     | 0     | -1    | 0     | -1    | 1     | 0     | 2   | $2/1 = 2$  |
| $x_2$                 | 0     | 1     | 0     | 1     | 0     | 0     | 0     | 1     | 13  | $13/0 = 0$ |

Since -2 is the lowest value  $\therefore x_1$  - key column  
Hence Row  $s_1$  is key row

| iter Basic            | $x_1$ | $x_2$ | $x_3$ | $x_4$ | $s_1$ | $s_2$ | $s_3$ | $s_4$ | RHS | Ratio |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-------|
| 3 ( $z + x_1$ ) Z     | 0     | 0     | 0     | 4     | 2     | 4     | 0     | 1     | 7.5 |       |
| $x_1$                 | 1     | 0     | 0     | -1    | 1     | 0     | 0     | -1    | 2   |       |
| $x_3$                 | 0     | 0     | 1     | 1     | 0     | 1     | 0     | 0     | 8   |       |
| ( $s_3 - x_1$ ) $s_3$ | 0     | 0     | 0     | 0     | -1    | -1    | 1     | 1     | 0   |       |
| $x_2$                 | 0     | 1     | 0     | 1     | 0     | 0     | 0     | 1     | 13  |       |

Therefore :  $x_1 = 2$

$$x_2 = 15$$

$$x_3 = 8$$

$$x_4 = 0$$

Hence  $Z_{\min}$  (minimum cost) = 75 //