QM 350

Operations Research

Chapter 5

Answers

a. The final simplex tableau with c1 shown as the coefficient of x_1 is

		x_1	x_2	s_1	s_2	s_3	s_4	
Basis	c_B	c_1	9	0	0	0	0	
x_2	0	0	1	30/16	0	-21/16	0	252
s_2	0	0	0	-15/16	1	5/32	0	120
x_1	c_1	1	0	-20/16	0	30/16	0	540
s_4	0	0	0	-11/32	0	9/64	1	18
	z_j	c_1	9	$(270\text{-}20c_1)/16$	0	$(30c_1\text{-}189)/16$	0	$2268+540c_1$
	$c_j - z_j$	0	0	$(20c_1\text{-}270)/16$	0	$(189\text{-}30c_1)/16$	0	

$(20c_1 - 270) / 16 \leq 0 \Rightarrow c_1 \leq 13.5$
$(189 - 30c_1) / 16 \leq 0 \Rightarrow c_1 \geq 6.3$
Range: $6.3 \leq c_1 \leq 13.5$
b. Following a similar procedure for c_2 leads to
$(200 - 30c_2) / 16 \leq 0 \Rightarrow c_2 \geq 6\ 2/3$
$(21c_2 - 300) / 16 \leq 0 \Rightarrow c_2 \leq 14\ 2/7$
Range : $6\ 2/3 \leq c_2 \leq 14\ 2/7$
c. There would be no change in product mix, but profit will drop to 540 (10) + 252 (7) = 7164.
d. It would have to drop below \$6 2/3 or increase above \$14 2/7.
e. We should expect more production of deluxe bags since its profit contribution has increased. The new optimal solution is given by
$x_1 = 300$, $x_2 = 420$
Optimal Value: \$9300
f.
$252 + \Delta b_1 (30/16) \geq 0 \Rightarrow \Delta b_1 \geq -134.4$
$120 + \Delta b_1 (-15/16) \geq 0 \Rightarrow \Delta b_1 \leq 128$
$540 + \Delta b_1 (-20/16) \geq 0 \Rightarrow \Delta b_1 \leq 432$
$18 + \Delta b_1 (-11/32) \geq 0 \Rightarrow \Delta b_1 \leq 52.36$
therefore $-134.4 \leq \Delta b_1 \leq 52.36$
Range: $495.6 \leq b_1 \leq 682.36$
g. $480 \leq b_2$
h. $580 \leq b_3 \leq 900$
i. $117 \leq b_4$
j. The cutting and dyeing and finishing since the dual prices and the allowable increases are positive for both.

k.

Basis	c_B	x_1 10	x_2 9	s_1 0	s_2 0	s_3 0	s_4 0	
x_2	9	0	1	30/16	0	-21/16	0	3852/11
s_2	0	0	0	-15/16	1	5/32	0	780/11
x_1	10	1	0	-20/16	0	30/16	0	5220/11
s_4	0	0	0	-11/32	0	9/64	1	0
	z_j	10	9	70/16	0	111/16	0	86,868/11 = 7897 1/11
	$c_j - z_j$	0	0	-70/16	0	-111/16	0	

l. a. Since this is within the range of feasibility for b_1, the increase in profit is given by

$$\left(\frac{70}{16}\right)30 = \frac{2100}{16}$$

m. It would not decrease since there is already idle time in this department and 600 - 40 = 560 is still within the range of feasibility for b_2.

n. Since 570 is within the range of feasibility for b_1, the lost profit would be equal to

$$\left(\frac{70}{16}\right)60 = \frac{4200}{16}$$

p. The value of the objective function would go up since the first constraint is binding. When there is no idle time, increased efficiency results in increased profits.

q. No. This would just increase the number of idle hours in the sewing department.

m. Min $630 y_1 + 600 y_2 + 708 y_3 + 135 y_4$

s.t. $7/10\, y_1 + ½\, y_2 + y_3 + 1/10\, y_4 \geq 10$

$y_1 + 5/6\, y_2 + +2/3\, y_3 + ¼\, y_4 \geq 9$

$y_1, y_2, y_3, y_4 \geq 0$