3. Consider the following linear program:

Min 8X + 12Y

s.t. 1X + 3Y >= 9

2X + 2Y >= 10

6X + 2Y >= 18

X, Y >=$ 0

a. Use the graphical solution procedure to find the optimal solution.

b. Assume that the objective function coefficient for X changes from 8 to 6. Does the

optimal solution change? Use the graphical solution procedure to find the new optimal solution.
c. Assume that the objective function coefficient for X remains 8, but the objective function coefficient for Y changes from 12 to 6. Does the optimal solution change? Use the graphical solution procedure to find the new optimal solution.

d. The computer solution for the linear program in part (a) provides the following objective coefficient range information:

variable	Objective Coefficient	Allowable increase	Allowable decrease
X	8.00000	4.00000	4.00000
Y	12.00000	12.00000	4.00000

How would this objective coefficient range information help you answer parts (b) and (c) prior to re-solving the problem?

4. Consider the linear program in Problem 3. The value of the optimal solution is 48. Suppose that the right-hand side for constraint 1 is increased from 9 to 10.

a. Use the graphical solution procedure to find the new optimal solution.

b. Use the solution to part (a) to determine the dual value for constraint 1.

c. The computer solution for the linear program in Problem 3 provides the following right-hand-side range information:

Constraint		rhS value	Allowable increase	Allowable decrease
	1	9.00000	2.00000	4.00000
	2	10.00000	8.00000	1.00000
	3	18.00000	4.00000	Infinite

What does the right-hand-side range information for constraint 1 tell you about the dual value for constraint 1?

d. The dual value for constraint 2 is 3. Using this dual value and the right-hand-side range information in part (c), what conclusion can be drawn about the effect of changes to the right-hand side of constraint 2?

18. Davison Electronics manufactures two models of LCD televisions, identified as model A and model B. Each model has its lowest possible production cost when produced on Davison's new production line. However, the new production line does not have the capacity to handle the total production of both models. As a result, at least some of the production must be routed to a higher-cost, old production line. The following table shows the minimum production requirements for next month, the production line capacities in units per month, and the production cost per unit for each production line:

model	Cost per unit production New line	 Old line	minimum production requirements
A	$30	$50	50,000
B	$25	$40	70,000
Production Line Capacity	80,000	60,000	

Let

AN = Units of model A produced on the new production line

AO = Units of model A produced on the old production line

BN = Units of model B produced on the new production line

BO = Units of model B produced on the old production line

Davison’s objective is to determine the minimum cost production plan. The computer solution is shown in Figure 3.21.

Optimal Objective Value = 3850000.00000

Variable	Value	Reduced Cost
AN	50000.00000	0.00000
AO	0.00000	5.00000
BN	30000.00000	0.00000
BO	40000.00000	0.00000

Constraint	Slack/Surplus	Dual Value
1	0.00000	45.00000
2	0.00000	40.00000
3	0.00000	-15.00000
4	20000.00000	0.00000

Variable	Objective Coefficient	Allowable Increase	Allowable Decrease
AN	30.00000	5.00000	Infinite
AO	50.00000	Infinite	5.00000
BN	25.00000	15.00000	5.00000
BO	40.00000	5.00000	15.00000

Constraint	RHS Value	Allowable Increase	Allowable Decrease
----------	------------	----------	---------
1	50000.00000	20000.00000	40000.00000
2	70000.00000	20000.00000	40000.00000
3	80000.00000	40000.00000	20000.00000
4	60000.00000	Infinite	20000.00000

a. Formulate the linear programming model for this problem using the following four constraints:

Constraint 1: Minimum production for model A Constraint 2: Minimum production for model B Constraint 3: Capacity of the new production line Constraint 4: Capacity of the old production line

b. Using computer solution in Figure 3.21, what is the optimal solution, and what is the total production cost associated with this solution?

c. Which constraints are binding? Explain.

d. The production manager noted that the only constraint with a positive dual value is the constraint on the capacity of the new production line. The manager's interpretation of the dual value was that a one-unit increase in the right-hand side of this constraint would actually increase the total production cost by $15 per unit. Do you agree with this interpretation? Would an increase in capacity for the new production line be desirable? Explain.

e. Would you recommend increasing the capacity of the old production line? Explain.

f. The production cost for model A on the old production line is $50 per unit. How much would this cost have to change to make it worthwhile to produce model A on the old production line? Explain.

g. Suppose that the minimum production requirement for model B is reduced from 70,000 units to 60,000 units. What effect would this change have on the total production cost? Explain.

21. Round Tree Manor is a hotel that provides two types of rooms with three rental classes: Super Saver, Deluxe, and Business. The profit per night for each type of room and rental class is as follows:

		Rental Class		
		Super Saver	**Deluxe**	**Business**
Room	**Type I**	$30	$35	—
	Type II	$20	$30	$40

Type I rooms do not have high-speed Internet access and are not available for the Business rental class.

Round Tree's management makes a forecast of the demand by rental class for each night in the future. A linear programming model developed to maximize profit is used to determine how many reservations to accept for each rental class. The demand forecast for a particular night is 130 rentals in the Super Saver class, 60 rentals in the Deluxe class, and 50 rentals in the Business class. Round Tree has 100 Type I rooms and 120 Type II rooms.

a. Use linear programming to determine how many reservations to accept in each rental class and how the reservations should be allocated to room types. Is the demand by any rental class not satisfied? Explain.

b. How many reservations can be accommodated in each rental class?

c. Management is considering offering a free breakfast to anyone upgrading from a Super Saver reservation to Deluxe class. If the cost of the breakfast to Round Tree is $5, should this incentive be offered?

d. With a little work, an unused office area could be converted to a rental room. If the conversion cost is the same for both types of rooms, would you recommend converting the office to a Type I or a Type II room? Why?

e. Could the linear programming model be modified to plan for the allocation of rental demand for the next night? What information would be needed and how would the model change?