Linear Programming Practice Answers

1) Fill in the listed information for each constraint, and draw the line representing each constraint.

		x intercept	y intercept	$\|slope\|$.....
Constraint 1:	$x + y \leq 3,500$	3,500	3,500	1
Constraint 2:	$8x + 6y \leq 26,300$	3,287.5	4,383.33	1.333
Constraint 3:	$3x + 5y \leq 14,400$	4,800	2,880	0.6

Corner point A is where constraint 2 crosses the x axis
Corner point B is where constraint 1 crosses constraint 2.
Corner point C is where constraint 1 crosses constraint 3.
Corner point D is where constraint 3 crosses the y axis.
Note: it helps to label each constraint on the graph.

2) Calculate the exact coordinates of the four feasible region corner points. If c_x=12 and $c_y = 15$, determine the profit $c_x x + c_y y$ at each corner point. point. Circle the largest value for profit.

	x coordinate	y coordinate	Profit.....
Corner point A	3,287.5	0	39,450
Corner point B	2,650	850	44,550
Corner point C	1,550	1,950	47,850***optimum
Corner point D	0	2,880	43,200

3) For each corner point, list the absolute values of the slopes of the two lines that cross at that point. Then calculate the range of values for c_y that would make this point the optimal point, assuming that c_x remains constant at 12. Use the formula

$$|slope| = \frac{c_x}{c_y}$$

which can be rewritten as

$$c_y = \frac{c_x}{|slope|} = \frac{12}{|slope|}$$

	slope	range	.....	values	for	c_y
Corner point A	infinity	to	1.333	0	to	9
Corner point B	1.333	to	1	9	to	12
Corner point C	1	to	.6	12	to	20
Corner point D	.6	to	0	20	to	infinity

4) Which two constraints are binding at the optimal point in part (2)? 1 and 3

5) What is the shadow price of constraint 2? zero (because it is a non-binding constraint)

6) To find the shadow price for constraint 1, increase the capacity of that constraint by 1 and solve this equation system:

$$x + y = 3,501$$

$$3x + 5y = 14,400$$

Result: $x = 1,552.500, y = 1,948.500$, value = 47,857.50

The shadow price is the difference between the new value and the original value: $47,857.50 - 47,850.00 = 7.50$.

7) To find the shadow price for constraint 3, increase the capacity of that constraint by 1 and solve this equation system:

$$3x + 5y = 14,401$$

$$x + y = 3,500$$

Result: $x = 1,549.500, y = 1,950.500$, value = 47,851.50

The shadow price is the difference between the new value and the original value: $47,851.50 - 47,850.00 = 1.50$.