

Business 3700 Practice Examination II Answers

1a.

$$\begin{pmatrix} 20 & 40 \\ 7 & 9 \end{pmatrix} \begin{pmatrix} 3 & 4 \\ 80 & 10 \end{pmatrix}$$

$$\begin{pmatrix} (20 \times 3 + 40 \times 80) & (20 \times 4 + 40 \times 10) \\ (7 \times 3 + 9 \times 80) & (7 \times 4 + 9 \times 10) \end{pmatrix}$$

$$= \begin{pmatrix} 3260 & 480 \\ 741 & 118 \end{pmatrix}$$

b.

$$\begin{pmatrix} 6 & 0 & 8 \\ 4 & 3 & 9 \\ 1 & 2 & 7 \end{pmatrix} \begin{pmatrix} 120 \\ 300 \\ 250 \end{pmatrix}$$

$$\begin{pmatrix} (6 \times 120 + 0 \times 300 + 8 \times 250) \\ (4 \times 120 + 3 \times 300 + 9 \times 250) \\ (1 \times 120 + 2 \times 300 + 7 \times 250) \end{pmatrix}$$

$$= \begin{pmatrix} 2720 \\ 3630 \\ 2470 \end{pmatrix}$$

c.  $(4 \times 2)(4 \times 2)$ : cannot be done; 2 does not equal 4

2.  $x + y \geq 600$

$$8x + 6y \geq 4,000$$

$$24x + 32y \geq 15,000$$

solution:  $(x = 525, y = 75)$ ; graph is on the internet

	Price range for $y$	Isocost slope	Amount of $y$ purchased
	less than 3	greater than $4/3$	$666\frac{2}{3}$
(c)	3 to 4	$4/3$ to 1	400
	4 to $5\frac{1}{3}$	1 to $3/4$	75
	greater than $5\frac{1}{3}$	less than $3/4$	0

**3.**  $x + y + s_1 = 44$

$$10x + 15y + s_2 = 600$$

$$40x + 20y + s_3 = 1400$$

solution:  $(x = 12, y = 32)$ ; value=40,400; graph is on the internet.

To produce all cellos, the slope (absolute value) must be less than  $2/3$ .

$p_x/p_y = 2/3$ ;  $700/p_y = 2/3$ ;  $p_y = 700 \times 3/2 = 2100/2 = 1050$ . Therefore, produce all cellos if the price of cellos is greater than 1050.

To produce all violins, the slope (absolute value) must be greater than 2.

$p_x/p_y = 2$ ;  $p_x/1000 = 2$ ;  $p_x = 2 \times 1000 = 2000$ . Therefore, produce all violins if the price of violins is greater than 2000.

Constraint 3 is non-binding, so its shadow price is 0.

to find the shadow price for constraint 1:

$$x + y = 45$$

$$10x + 15y = 600$$

Solve this equation system to find  $x = 15$ ,  $y = 30$ . The value would be  $700 \times 15 + 1000 \times 30 = 40,500$ . The shadow price is  $40,500 - 40,400 = 100$ .

to find the shadow price for constraint 2:

$$x + y = 44$$

$$10x + 15y = 601$$

Solve this equation system to find  $x = 11.8$ ,  $y = 32.2$ . The value would be  $700 \times 11.8 + 1000 \times 32.2 = 40,460$ . The shadow price is  $40,460 - 40,400 = 60$ .

**4. (a)** determinant= $7 \times 9 - 4 \times 10 = 63 - 40 = 23$  solution:  $x = 28.6957$ ;  $y = -25.2174$ .

**(b)** determinant= $14 \times 9 - 21 \times 6 = 0$ . Each coefficient in the second equation is 1.5 times the corresponding coefficient in the first equation, so these equations both represent the same line and there are an infinite number of solutions, all along that line.

**(c)** determinant= $18 \times 96 - 72 \times 24 = 0$ .  $24/18 = 96/72$ , but  $96/72$  does not equal  $800/250$ , so there are no solutions (the lines are parallel).