HW7

Homework 7

Please answer the following questions about probabilistic modeling.

Question 1:

Nutritional Requirements—A rancher has determined that the minimum weekly nutritional requirements for an average-sized horse include 40 lb of protein, 20 lb of carbohydrates, and 45 lb of roughage. These are obtained from the following sources in varying amounts at the prices indicated:

	Protein (lb)	Carbohydrates (lb)	Roughage (lb)	Cost
Hay (per bale)	0.5	2.0	5.0	$1.80
Oats (per sack)	1.0	4.0	2.0	3.50
Feeding blocks (per block)	2.0	0.5	1.0	0.40
High-protein concentrate (per sack)	6.0	1.0	2.5	1.00
Requirements per horse (per week)	40.0	20.0	45.0	

Formulate a mathematical model to determine how to meet the minimum nutritional requirements at minimum cost.

Question 2:

Mixing Nuts—A candy store sells three different assortments of mixed nuts, each assortment containing varying amounts of almonds, pecans, cashews, and walnuts. To preserve the store's reputation for quality, certain maximum and minimum percentages of the various nuts are required for each type of assortment, as shown in the following table:

Nut assortment	Requirements	Selling price per pound
Regular	Not more than 20% cashews Not less than 40% walnuts Not more than 25% pecans No restriction on almonds	$0.89
Deluxe	Not more than 35% cashews Not less than 25% almonds No restriction on walnuts and pecans	1.10
Blue Ribbon	Between 30% and 50% cashews Not less than 30% almonds No restriction on walnuts and pecans	1.80

The following table gives the cost per pound and the maximum quantity of each type of nut available from the store's supplier each week.

Nut type	Cost per pound	Maximum quantity available per week (lb)
Almonds	$0.45	2000
Pecans	0.55	4000
Cashews	0.70	5000
Walnuts	0.50	3000

The store would like to determine the exact amounts of almonds, pecans, cashews, and walnuts that should go into each weekly assortment to maximize its weekly profit. Formulate a mathematical model that will assist the store management in solving the mixing problem. *Hint:* How many decisions need to be made? For example, do you need to distinguish between the cashews in the regular mix and the cashews in the deluxe mix?

Question 3:

Solve Problems below using graphical analysis.

(a)

Maximize $10x + 35y$
subject to

$$8x + 6y \leq 48 \quad \text{(board-feet of lumber)}$$
$$4x + y \leq 20 \quad \text{(hours of carpentry)}$$
$$y \geq 5 \quad \text{(demand)}$$
$$x, y \geq 0 \quad \text{(nonnegativity)}$$

(b)

Minimize $5x + 7y$
subject to

$$2x + 3y \geq 6$$
$$3x - y \leq 15$$
$$-x + y \leq 4$$
$$2x + 5y \leq 27$$
$$x \geq 0$$
$$y \geq 0$$

Question 4:

Using the algebraic method to solve Problems again

(a)

Maximize $10x + 35y$
subject to

$$8x + 6y \leq 48 \quad \text{(board-feet of lumber)}$$
$$4x + y \leq 20 \quad \text{(hours of carpentry)}$$
$$y \geq 5 \quad \text{(demand)}$$
$$x, y \geq 0 \quad \text{(nonnegativity)}$$

(b)

Minimize $5x + 7y$
subject to

$$2x + 3y \geq 6$$
$$3x - y \leq 15$$
$$-x + y \leq 4$$
$$2x + 5y \leq 27$$
$$x \geq 0$$
$$y \geq 0$$

Due: 10:00am 5 May. **. Please email your homework to TA.**