King Fahd University of Petroleum and Minerals

Major 1 Math 131-122

February 23, 2013

Prob. 1
A manufacturer of video-game cartridges sells each cartridge for $21.95. The manufacturing cost of each cartridge is $14.92. Monthly fixed costs are $8500. During the first month of sales of a new game, how many cartridges must be sold in order for the manufacturer to break even (that is, in order that the total revenue equal total cost)?

Prob. 2
A company produces alarm clocks. During the regular workweek, the labor cost for producing one clock is $2.00. However, if a clock is produced overtime, the labor cost is $3.00. Management has decided to spend no more than $25,000 per week for labor. The company must produce 11,000 clocks this week. What is the minimum number of clocks that must be produced during the regular workweek?

Prob. 3
An electric utility company charges residential customers 12.5 cents per kilowatt hour plus a base charge each month. One customer's monthly bill comes to $51.65 for 380 kilowatt hours. Find a linear function that describes the total monthly charges for electricity if x is the number of kilowatt hours used in a month.

Prob. 4
Graph the function $y = x(x + 3) - 12$, give the vertex and intercepts and state the range

Prob. 5
A coffee wholesaler blends together three types of coffee that sell for $2.20, $2.30 and $2.60 per pound, so as to obtain 100 lb of coffee worth $2.40 per

pound. If the wholesaler uses the same amount of the two higher priced coffees, how much of each type must be used in the blend?

Prob. 6

Solve the nonlinear systems

(a)

$$\begin{cases} z = 4/w \\ 3z = 2w + 2 \end{cases}$$

(b)

$$\begin{cases} 2x = y + 8 \\ y = 5\sqrt{x + 1} \end{cases}$$

Prob. 7

A manufacturer sells a product at \$8.35 per unit, selling all produced. The fixed cost is \$2116 and the variable cost is \$7.20 per unit. At what level of production will there be a profit of \$4600? At what level of production will there be a loss of \$1150? At what level of production will the break-even point occur?

Prob.8

Solve the system of inequalities

$$\begin{cases} 4x + 3y \geq 12 \\ y \geq x \\ 2y \leq 3x + 6 \end{cases}$$

Prob.9

The highway department has decided to add exactly 200 km of highway and 100 km of expressway to its road system this year. The standard price for road construction is \$1 million per kilometer of highway and \$5 million per kilometer of expressway. Only two contractors company A and B, can do this kind of construction, so the entire 300 km of road must be built by these two companies. However, company A can construct at most 200 km of roadway (highway and expressway) and company B can construct at most 150 km. For political reasons, each company must be awarded a contract with a standard price of at least \$250 million (before discounts). Company A offers a discount of \$1000 per kilometer of highway and \$6000 per kilometer of expressway; Company B offers a discount of \$2000 per kilometer of highway and \$5000 per kilometer of expressway.

(a) Let x and y represent the number of kilometers of highway and express way, respectively, awarded to company A. Show that the total discount

received from both companies is given by $D = 900 - x + y$, where D is in thousands of dollars.

(b) The highway department wishes to maximize the total discount D. Show that this problem is equivalent to the following linear programming problem, by showing exactly how the first four constraints arise: Maximize $D = 900 - x + y$, subject to

$$\begin{cases} x + y \leq 200 \\ x + y \geq 150 \\ x + 5y \geq 250 \\ x + 5y \leq 450 \\ x, y \geq 0. \end{cases}$$

(c) Find the values of x and y that maximize D.

Prob.10

A small business predicts its revenue growth by a straight-line method with a slope of \$50,000 per year. In its fifth year, it had revenues of \$330,000. Find an equation that describes the relationship between revenues, R, and the number of years, T, since it opened for business.