Name: _____

Group members:

Quiz 3.2: Setting up word problems

Ivy Dahoe oversees two of the family mines in the northern United States and tries to minimize costs while meeting the family businesses production goals. The Alene mine costs \$15,000 per day to operate and produces 3000 oz. of silver, 25 tons of lead, and 30 tons of zinc. The Blackfoot mine costs \$18,000 per day to operate and produces 1800 oz. of silver, 30 tons of lead, and 27 tons of zinc. This quarter the family business production demands 60,000 oz. of silver, 650 tons of lead, and 650 tons of zinc. Ivy wants to hire you to help run the business, but to prove you can handle it, she wants to know how many days you think she should run each mine in order to meet the quarterly production goals while minimizing the cost.

What are the variables describing the business decision to be made?

What are the constraints on those variables?

How is the business decision evaluated? What is the objective function?

($\star$) What is your best advice for Ivy? How many days should she run each mine? How much surplus will she have of each metal? How much will it cost?

Note you will be fired if you misreport the cost or surplusses (or if you have shortages)! The group with the minimum cost (amongst those not fired), will earn 3 bonus points on the next exam. Second place receives 1 point.　　　Can you beat \$400k cost?

Examples 3.2: Setting up optimization problems

Please do several of the odd problems in chapter 3.2, p.185-188.

You are assisting a farmer with planning for the next year. He has 150 acres of land for crops, $7400 in capital for seed, fertilizer, water, etc., and 3300 hours of labor available to work the fields. He is considering two types of crops. The first costs $40 and 20 hours of labor per acre, and the second costs $60 and 25 hours of labor per acre. You expect the crops to produce about $150 and $200 per acre in profit, respectively.

$$\begin{cases} \text{Maximize:} \\ \$150x + \$200y \\ \text{subject to:} \\ \quad x + \quad y \leq \quad 150 \\ \$40x + \$60y \leq \$7400 \\ \quad 20x + \quad 25y \leq \quad 3300 \\ \qquad\quad x, y \geq \quad 0 \end{cases}$$

Let x be the number of acres to plant of the first crop, and let y be for the second crop.

Roger has $3000 to invest and is considering three investment options: a savings account earning 0.1% interest, a certificate of deposit earning 1% interest, or a mutual fund which could earn 3% interest, but might also default (lose all his money). He needs to have at least $1000 available at all times to cover emergencies (so does not want to invest it in the CD or the mutual fund), and at the end of the year he needs to have at least $2000 in order cover his upcoming (used) car purchase, so he does not want to risk putting that money in the unsecured mutual fund.

$$\begin{cases} \text{Maximize:} \\ 1.001S + 1.01C + 1.03M \\ \text{subject to:} \\ \quad S + C + M \leq 3000 \\ \qquad\quad C + M \leq 2000 \\ \qquad\qquad\quad M \leq 1000 \\ \quad S, C, M \geq 0 \end{cases}$$

Let S be the number of dollars invested in the savings account, C be the amount in the CD, and M be the amount in the mutual fund.