MTH 245 Project

This project is to be done with a partner. You will have a little bit of in-class time to work on this but the majority of the work will need to take place outside of class.

Think of this as submitting a proposal to a client—you've been hired to look over my business, evaluate it and give me suggestions for increasing profits. You will prepare a report for me that will include the answers to the questions listed below. **Presentation is critical**, as is explaining what you did and why. Your proposal should be in typed and in paragraph form and readable by anyone, not just a MTH245 student. You can include supporting equations, graphs, etc., as appropriate. The content and layout of the report is up to you; just make sure that the first page contains your names somewhere. You must submit a hard copy of your report.

The Scenario

I have a home business that makes 2 kinds of goat milk soap: basic and deluxe. The soap is made from goat milk, olive oil, lye, and essential oil. The deluxe also uses fresh flower petals. In the past, I have varied the amount of each type of soap I make each time, but I want to determine how many bars of each type of soap I should make in order to maximize the weekly profits.

Each batch of soap makes 12 bars. Each batch requires an hour and a half to mix. After I mix a batch, it is poured into one of my soap molds, I only own 10 soap molds and each batch of soap exactly fills up a mold. The soap must then sit for 2 days before I cut it. Generally, I mix up 10 batches on Monday, cut them out of the mold on Wednesday and then make 10 more batches. I cut those last batches out on Friday.

A batch of basic soap requires 720 g of olive oil, 220 g of goat milk, 1 g of essential oil and 64g of lye. A batch of deluxe requires 680 g of olive oil, 280 g of goat milk, 5 g of essential oil and 66g of lye, in addition to the flower petals. My goat, Squirt, produces an average of 48 ounces of milk a day, half of which we drink. I receive a shipment of 2 ounces of essential oil a week at a cost of $30. I also have a regular shipment of olive oil and lye that arrives each Monday. My standing order is for 5 bottles of olive oil (3 L/102 ounces each) for a cost $158.70 and 3 pounds of lye for a cost of $28.35. The flower petals I collect in my garden, and I can collect enough for 7 batches a week. For the soap to turn out just right, it's important that the goat milk, essential oil and petals I use to all be fresh. The olive oil and lye are readily available and will keep for a reasonable length of time.

I sell the soap on Saturdays and Sundays at a Farmer's Market. The basic soap I sell for $5.50 a bar and the deluxe for $6.00. The soap is really popular and I always sell out all that I make. I've estimated my weekly operating costs including goat feed, insurance, utilities, etc. to be $12 a week. I am not paying myself a wage.

Your proposal should include answers to all these questions. Please do not just number the page and list the answers.

1. Identify the Revenue, Cost and Profit equations for the given scenario. Be sure to identify your variables.
2. Find the constraint equations and set up the linear program to be optimized.
3. Determine the optimal solution for my soap business using excel and solver.
4. Make 3 recommendations for ways to increase my profits.
    a) Propose a change in revenue that will not change the number of bars of each type produced.
    b) Propose a change in the constraints.
    c) Propose another way to increase profits.

    The recommendations should be **specific**. For each proposed change, start with the original problem and make changes to it. Identify what your suggested change is, what the optimal solution would be and what the associated profits would be. Include any other impact or other considerations I need to be aware of.
5. Summarize your results. Then, tell me which recommendation I should implement and what percent increase it makes in my profits from the original solution.