

Linear Programming Class Work

🦋 **Objective:** *You will be able to solve problems involving maximization/minimization of real world situations via designing and solving systems of inequalities to model the situations.*

★ *Example:* A concession stand at a baseball game sells popcorn and cotton candy. To stay in business each day, at least 10 bags of popcorn must be sold. No more than 40 bags of popcorn can be made. Also, at least 30 orders of cotton candy must be sold so that the owners of the concession stand do not lose money, but there are not enough supplies to make more than 100 orders of cotton candy per day. The owners of the concession stand make a profit of \$1.23 on every bag of popcorn sold and 38 cents on every order of cotton candy sold. How many of each item should the people at the stand sell in order to maximize profit for the day?

→ *First determine what we call an **objective function**. This function is **not** one of the constraints, but is rather the function that involves the variable that needs to be maximized / minimized.*

→ *Next, determine and graph the constraints. We call this a **feasible** region. Remember to define the variables.*

→ *Finally, test each vertex of the feasible region in the objective function. One of the vertices will be a maximum and one will be a minimum (this is an accepted algebraic theorem).*

 **Now You Try Some!** (Show work on a separate sheet of paper.)

1. Emily is taking a test in which multiple-choice questions are worth 10 points and open-ended questions are worth 15 points each. It takes Emily 2 minutes to answer each multiple-choice question and four minutes to answer each open-ended question. Emily is allowed one hour to complete the test, and she is only allowed to answer at most 20 questions. How many items of each type should Emily answer to achieve the highest score, assuming all of her answers are correct?
2. A group of friends are creating blankets and bags of toiletries to hand out to the less fortunate. It costs \$5 per blanket and \$3 per bag of toiletries. They only have room to bring 100 items, but do not want to bring less than 60 items. They were told to bring at least 20 blankets and 30 bags of toiletries. How many blankets and bags of toiletries should the group make in order to minimize their cost?
*each blanket is one “item,” and each bag is one “item”
3. Paula and her friends are creating bracelets and necklaces to sell as a way to fundraise for their favorite charity. Due to their supplies, Paula realizes that they must make at least 20 bracelets, but cannot make any more than 120 bracelets, and the number of necklaces should be at least twice the number of bracelets. She also notices that there is not enough material to make over 200 necklaces. The profit per bracelet is \$2.50, and the profit per necklace is \$2.83. How much of each type of jewelry should Paula and her friends make to maximize profit, assuming they will sell all of the items?
4. Joey wrote a book recently, and would like for his book to be published. In order to make one copy of the book to send to publishers, Joey hires someone to type and arrange the book. The charge for pages that have pictures is \$3.35, and the charge for pages without pictures is \$2.23. Joey knows that he has at least 20 pages without pictures, and that the total book will be 80 pages or less. What is the greatest possible cost that Joey should expect to pay for his book to be arranged?
5. Sarah is baking rice crispie treats that also have white chocolate and fruity pebbles in them for her friends, her family, her students, and some homeless shelters for the holidays. For the amount of treats Sarah wants to make, she needs at least five bags of white chocolate chips, and at least four boxes of fruity pebbles. White chocolate chips cost \$3.89 per bag, and fruity pebbles cost \$2.28 per box. Sarah knows that she will not need more than 24 items in total (bags of white chocolate and boxes of fruity pebbles combined) and that she needs twice as many fruity pebble boxes as white chocolate bags. Determine the range of how much money Sarah should expect to spend.
6. Kyle would like to burn the maximum amount of calories during his workout today. While running, Kyle burns 11 calories per minute, and while lifting weights, Kyle burns 8.5 calories per minute. Kyle would like to run for at least 7 minutes, but no longer than 30 minutes. Kyle would also like to lift weights for at least 10 minutes, and is planning on working out for no more than one hour. How many minutes of each exercise should Kyle do in order to maximize his calorie burn?

- *In your own words, describe the difference between a constraint and the objective function.*
- *In your own words, describe how to determine the vertices of the feasible region.*
- *Write down any questions you still have regarding linear programming.*