MINDSET Activity - Linear Programming Maximization

The Problem

A certain furniture company makes only two products: tables and chairs. The manufacturing of tables and chairs can be modeled using Lego pieces. To make a table requires two large and two small pieces, and a chair requires one large and two small pieces. Figure 2.0.1 shows a table and a chair made from Legos.

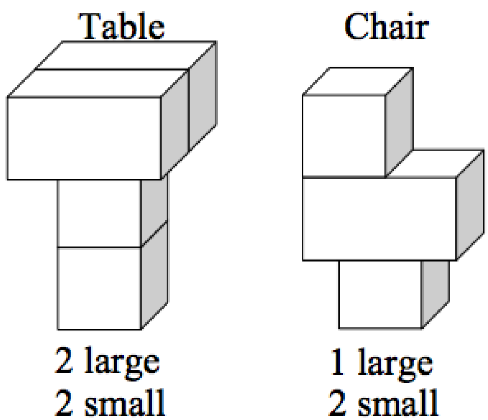

Figure 2.0.1: A Lego table and chair

If the resources needed to build tables and chairs were unlimited, the company would just manufacture as many of each as it thought it could sell. In the real world, however, resources are not unlimited. Suppose that the company can only obtain six large and eight small pieces per day. Figure 2.0.2 shows these limited resources.

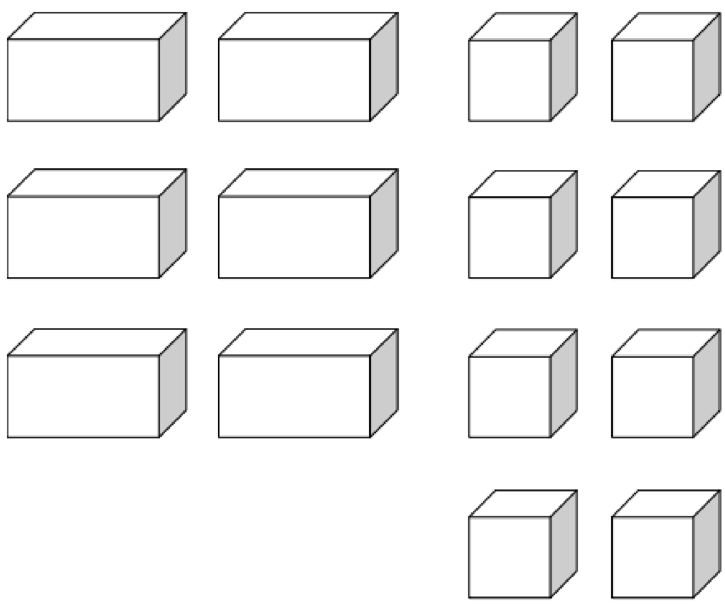

Figure 2.0.2: The furniture company's limited resources

The profit from each table is $16, and the profit from each chair is $10. The production manager wants to find the rate of production of tables and chairs per day that earns the most profit. Production rate refers to the number of tables and chairs this company can produce per day.

Q1. What do you think the production rates should be in order to generate the most profit?

Q2. Does the number of table and chairs produced each day have to be an integer value?

Q3. Using only eight small and six large Legos, build a physical model of this problem. If Legos are unavailable, draw pictures to explore some possibilities. Create several combinations of tables and chairs this company could make using your model.

Q4. In a Table 2.0.1, record other combinations of tables and chairs the company could produce. For each combination, write the production rate of tables, the production rate of chairs, and the profit for each possibility.

Production Rate of Tables	Production Rate of Chairs	Total Profit

Q5. Which production rates generate the most profit?

Q6. Did any product mix yield a profit greater than $52?

Q7. Why is building four tables an example of an infeasible solution?

Q8. Give another example of an infeasible solution.

Q9. Would it make a difference if seven large pieces were available instead of six (there are still eight small pieces)? If so, what is the new optimal solution, and how much profit does it generate?

Q10. Would it make a difference if nine small pieces were available instead of eight (there are still six large pieces)? If so, what is the new optimal solution, and how much profit does it generate?

Q11. Would it make a difference if seven large pieces and nine small pieces were available? If so, what is the new optimal solution, and how much profit does it generate?

Q12. What should the daily production rates be in order to maximize profit?

Suppose now that the furniture company has decided to dramatically expand production. Now it is able to obtain 27 small and 18 large Lego pieces per day. The profit on tables and chairs remains the same.

Q13. Would it make a difference if 19 large pieces were available instead of 18 (there are still 27 small pieces)? If so, what is the new optimal solution, and how much profit does it generate?

Q14. Would it make a difference if 28 small pieces were available instead of 27 (there are still 18 large pieces)? If so, what is the new optimal solution, and how much profit does it generate?

Q15. Was this new problem easier or more difficult to solve than the original? Why?