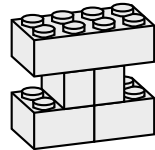# Introducing Optimization to First Graders
A Hands-On Exercise[1]

Patty-O FunnyTure

You are the new manager of a big furniture factory in Miami called *Patty-O FunnyTure*. The factory makes and sells two products, a bench and a chair, which look like this:
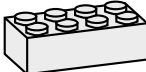

The Brickell bench   The Wynwood chair

To make these products, you will use three types of Lego pieces, but the factory only has a limited quantity of each piece:

You can use up to 15 pieces like this

up to 9 pieces like this

and up to 4 pieces like this

If you do not have enough Lego pieces in these types and quantities at home, no problem! They are drawn on the last page of this document. Ask a parent or teacher to print that page for you and use a pair of scissors to cut them out. They will work just like actual Legos.

Question 1: If you only want to make benches, how many can you make? _____

Question 2: If you only want to make chairs, how many can you make? _____

Question 3: If you want to make some benches and some chairs, how
   many of each can you make? (Try to use as many pieces as you can.) _____

So far so good, huh? But wait... This factory is a business! Making furniture costs money because you need to buy the Lego pieces, right? Turn the page for your next challenge.

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[1]This activity was created by Prof. Tallys Yunes from the University of Miami. It is licensed under a Creative Commons Attribution-NonCommercial 3.0 Unported License.

Here is how much it costs to buy each type of Lego piece that you need to use:

Each costs $1, each costs $2, and each costs $4.

Question 4: How much does it cost to make a bench? _____

Question 5: How much does it cost to make a chair? _____

Great job so far! But if you make all this furniture, you might as well try to sell it to someone, right? Then you can use that money for something you want, like mystery books!

Your friend Frédéric sees the benches you made and tells you he likes them very much and wants to buy them. He will pay you $40 for each bench.

Your friend Clara sees the chairs you made and tells you she likes them very much and wants to buy them. She will pay you $21 for each chair.

Because you need to spend money to make a bench (see Question 4), you will not be able to keep the whole $40 that Frédéric will pay you, right? How much leftover money will you have for each bench you sell to him?

$$40 \qquad - \quad \rule{3cm}{0.4pt} \quad = \quad \rule{3cm}{0.4pt}$$

Money Frédéric pays me for one bench	Money I spend making one bench	Money I have left for each bench I sell

Did you know that there is a special name for this leftover money you get from making and selling something? It is called the **profit**.

Question 6: What is the **profit** (leftover money) for each bench? _____

Now find the profit value for each chair:

$$21 \qquad - \quad \rule{3cm}{0.4pt} \quad = \quad \rule{3cm}{0.4pt}$$

Money Clara pays me for one chair	Money I spend making one chair	Money I have left for each chair I sell

Question 7: What is the **profit** for each chair? _____

Are you up for one final challenge? Turn the page and let's go for it!

Question 8: Remember your answer to Question 1? If your factory only makes benches and sells them all to Frédéric, how much profit do you make in total? _____

Question 9: Remember your answer to Question 2? If your factory only makes chairs and sells them all to Clara, how much profit do you make in total? _____

Question 10: Remember your answer to Question 3? If your factory makes some benches and some chairs, and sells all of them, how much profit do you make in total? _____

Question 11: Which of the three answers above creates the most profit?

☐ Making and selling only benches creates the most profit.

☐ Making and selling only chairs creates the most profit.

☐ A mixture of benches and chairs creates the most profit.

Mega Challenge Question: It is possible to make a total profit of $138 if you choose the right number of benches and chairs to make and sell. Did your answer to Question 10 equal to $138? If so, great job! If not, try to find out how many benches and chairs you need to make and sell to reach the largest possible profit of $138.

Did You Know?

The largest possible total profit has a special name: it is called the **maximum profit**.

The answer to the Mega Challenge Question (how many benches and chairs to make and sell to reach the maximum profit) also has a special name: it is called the **optimal solution**.

Lego Pieces to Cut Out If Needed