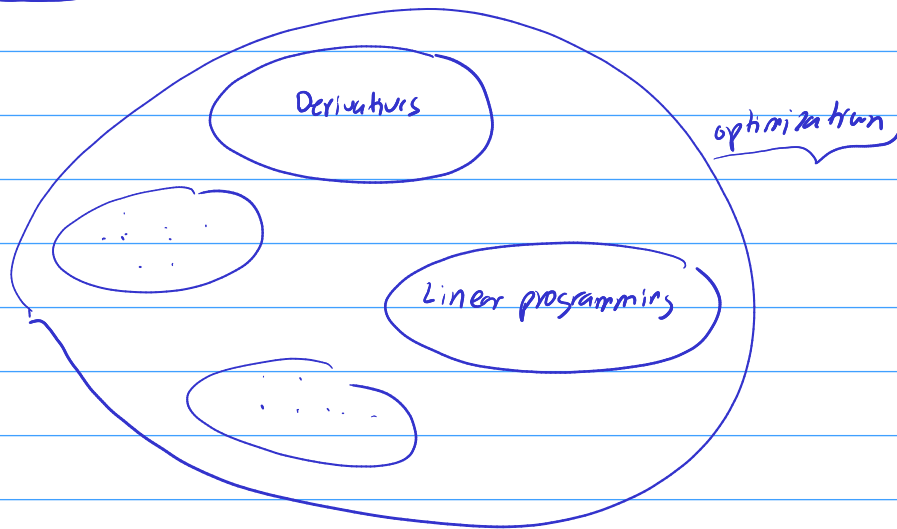


Optimization



Linear programming

Example

A toy manufacturer makes wooden blocks and horses. The production process involves two basic types of labor: carpentry and design. A block requires 2 hours of carpentry and 1 hour of design, and a horse requires 1 hour of carpentry and 3 hours of design. [The profit is \$10 per block and \$14 per horse.] The manufacturer's employees can supply a maximum of 10 hours of carpentry work and 15 hours of design work per day. How many blocks and horses should be made each day to maximize profit?

x y

Step 1: Name variables and set up the linear programming prob.

Step 2: Use Excel to solve the problem.

Step 1: x : number of blocks
 y : number of horses

Profit: $10x + 14y$

constraint 1:

To produce x blocks and y horses, how many carpentry hours do we need?

1 block : needs $\begin{cases} 2 \text{ hours of carpentry} \\ 1 \text{ hour of design} \end{cases}$

\Rightarrow $\underbrace{x \text{ blocks needs}} \begin{cases} 2x \text{ hours of carpentry} \\ x \text{ hours of design} \end{cases}$

1 horse needs $\begin{cases} 1 \text{ hour of carpentry} \\ 3 \text{ hours of design} \end{cases}$

$\underbrace{y \text{ horses need}} \begin{cases} y \text{ hour of carpentry} \\ 3y \text{ hours of design} \end{cases}$

In total

$x \text{ blocks} + y \text{ horses need} \begin{cases} 2x + y \text{ h. carpentry} \\ x + 3y \text{ h. design} \end{cases}$

we have

constraint.
$$\begin{cases} 2x + y \leq 10 \\ x + 3y \leq 15 \end{cases}$$

maximize

$$10x + 14y$$

under the constraints:

$$\begin{cases} 2x + y \leq 10 \\ x + 3y \leq 15 \end{cases}$$

Step 2