

# Homework 2 (Vanderbei Exercise 1.1)

```
In [ ]: import sys
        !{sys.executable} -m pip install pulp
```

```
In [ ]: import pulp
        from pulp import *
```

```
In [ ]: """
        The Steel Company Band and Coil Production Problem

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        """
```

## Textbook Problem

- 1.1 A steel company must decide how to allocate next week's time on a rolling mill, which is a machine that takes unfinished slabs of steel as input and can produce either of two semi-finished products: bands and coils. The mill's two products come off the rolling line at different rates:

Bands	200 tons/h
Coils	140 tons/h.

They also produce different profits:

Bands	\$25/ton
Coils	\$30/ton.

Based on currently booked orders, the following upper bounds are placed on the amount of each product to produce:

Bands	6,000 tons
Coils	4,000 tons.

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### 1. INTRODUCTION

Given that there are 40 h of production time available this week, the problem is to decide how many tons of bands and how many tons of coils should be produced to yield the greatest profit. Formulate this problem as a linear programming problem. Can you solve this problem by inspection?

## Steel Company Band and Coil Production Problem

$$\begin{aligned}
 &\text{Maximize} && 25 * \text{bands} + 30 * \text{coils} \\
 &\text{Subject to} && 140 * \text{bands} + 200 * \text{coils} = 40 * 200 * 140 \\
 &&& 0 \leq \text{bands} \leq 6000 \\
 &&& 0 \leq \text{coils} \leq 4000
 \end{aligned}$$

```
In [ ]:
```

```
In [ ]: # Create a LP Maximization Problem.
LP_Prob = LpProblem('Steel_Company_Problem', LpMaximize)
```

```
In [ ]: # Create Decision Variables.
bands = pulp.LpVariable(name = 'bands', lowBound = 0, upBound = 6000)
coils = pulp.LpVariable(name = 'coils', lowBound = 0, upBound = 4000)
```

```
In [ ]: # Add Objective Function to LP Problem.
LP_Prob += 25 * bands + 30 * coils, 'Total_Profit'

# Now Add Constraints.
LP_Prob += 140 * bands + 200 * coils == 40 * 200 * 140
LP_Prob += bands <= 6000, 'Upper_Limit_Bands'
LP_Prob += coils <= 4000, 'Upper_Limit_Coils'
```

```
In [ ]: # Write the LP Problem to a File.
LP_Prob.writeLP('SteelCompanyProblem.lp')

# Display the LP Problem.
print(LP_Prob)
```

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In [ ]: LP_Prob.solve()
```

```
In [ ]: print(f'Status: {LpStatus[LP_Prob.status]}\n')

for variable in LP_Prob.variables() :
    print(f'{variable.name} = {variable.varValue}')
if (LpStatus[LP_Prob.status] == 'Optimal') :
    print(f'Optimal Value : Z = {value(LP_Prob.objective)}')
else :
    print(f'No Optimal Value. Status Code : {value(LP_Prob.objective)}')
```