MSDS 460 Decision Analytics

Assignment 01

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Problem:

SteelCo manufactures three types of steel at two different steel mills.

During a given month, mill 1 has **200** hours of blast furnace time available, whereas mill 2 has **300** hours.

Because of differences in the furnaces at each mill, the time and cost to produce a ton of steel differs for each mill and are shown in the following table.

	Steel 1		Steel 2		Steel 3	
	Cost ($)	Time (Min)	Cost ($)	Time (Min)	Cost ($)	Time (Min)
Mill 1	10	20	11	22	14	28
Mill 2	12	24	9	18	10	30

Each month, SteelCo must manufacture a total of at least:

- **400** tons of Steel 1
- **500** tons of Steel 2 and
- **300** tons of Steel 3 to meet demand;

however, the total amount of Steel 2 manufactured should not exceed the combined amount of Steel 1 and Steel 3.

Also, in order to maintain a roughly uniform usage of the two mills, management's policy is that the percentage of available blast furnace capacity (time) used at each mill should be the same.

Solution:

Decision Variables:

Let,

X_{ij} = tons of steel type i produced in mill j

Where,

i = 1, 2 and 3 for steel types 1, 2 and 3 respectively

j = 1 and 2 for Mill 1 and 2 respectively

Objective Function:

Min Z = $\$10X_{11} + \$12_{12} + \$11X_{21} + \$9X_{22} + \$14X_{31} + \$10X_{32}$

s.t.,

Production hours:

Mill 1: $20x_{11} + 22X_{21} + 28X_{31} <= 12{,}000$

Mill 2: $24x_{12} + 18X_{22} + 30X_{32} <= 18{,}000$

Steel Demand:

$X_{11} + X_{12} >= 400$

$X_{21} + X_{22} >= 500$

$X_{31} + X_{32} >= 300$

Combined Constraint:

$X_{21} + X_{22} <= X_{11} + X_{12} + X_{31} + X_{32}$

Blast Capacity:

$((20X_{11} + 22X_{21} + 28X_{31})/12{,}000) == ((24x_{12} + 18X_{22} + 30X_{32})/18{,}000)$

Non-negative constraints:

All X_{ij} >= 0