

Comp 360 A1

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Problem

A steel factory produces both raw steel and refined products. The refined products the factory produces include staples, nails, and screws. Each day the factory must guarantee a production of at least 80 staples, 25 nails, and 20 screws. In addition to this the factory produces each of its refined products in three grades; poor, average, and premium.

Product	Grade	Cost	Value
Staple	Poor	10	15
Staple	Average	15	25
Staple	Premium	25	40
Nail	Poor	15	20
Nail	Average	25	40
Nail	Premium	30	50
Screw	Poor	70	80
Screw	Average	100	110
Screw	Premium	115	130

The factory is willing to use 1000 worth of their raw steel in order to create their premium products. Additionally, The company is running a promotion at this time and with every 10 average items sold, 1 free premium item will be given to the costumer. How much of each product must be sold to maximize the companies revenue?

Solution

Variables

- Staple-poor = x_1
- Staple-average = x_2
- Staple-premium = x_3
- Nail-poor = x_4
- Nail-average = x_5
- Nail-premium = x_6
- Screw-poor = x_7
- Screw-average = x_8
- Screw-premium = x_9

Objective

Maximize:

$$15x_1 + 25x_2 + 40x_3 + 20x_4 + 40x_5 + 50x_6 + 80x_7 + 110x_8 + 130x_9$$

Subject To

$$10x_1 + 15x_2 + 25x_3 + 15x_4 + 25x_5 + 30x_6 + 70x_7 + 100x_8 + 115x_9 \leq 1000,$$

$$x_1 + x_2 + x_3 \geq 80,$$

$$x_4 + x_5 + x_6 \geq 25,$$

$$x_7 + x_8 + x_9 \geq 20,$$

$$x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 \geq 0,$$

$$-10x_2 + x_3 \geq 0,$$

$$-10x_5 + x_6 \geq 0,$$

$$-10x_8 + x_9 \geq 0,$$