MSDS 460 Decision Analytics

Assignment 03

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Problem 1:

The Tiny Toy Company makes three types of new toys: the tiny tank, the tiny truck, and the tiny turtle.

Plastic used in one unit of each is 1.5, 2.0 and 1.0 pounds, respectively.

Rubber for one unit of each toy is 0.5, 0.5, and 1.0 pounds, respectively.

Also, each tank uses 0.3 pounds of metal and the truck uses 0.6 pounds of metal during production.

The average weekly availability for plastic is 16,000 pounds, 9,000 pounds of metal, and 5,000 pounds of rubber.

It takes two hours of labor to make one tank, two hours for one truck, and one hour for a turtle.

The company allows no more than 40 hours a week for production (**priority #1**).

Finally, the cost of manufacturing one tank is $7, 1 truck is $5 and 1 turtle is $4; a target budget of $164,000 is initially used as a guideline for the company to follow.

1. Minimize over-utilization of the weekly available supply of materials used in making the toys and place twice as much emphasis on the plastic (**priority #2**).
2. Minimize the under and over-utilization of the budget. Maximize available labor hour usage (**priority #3**).

Solution:

**Goals:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Priority** | **Goal** | **Rank** | **Weight** |
| #1 | Max 40 hours / week | 3 | .35 |
| #2 | Min over-utilization of plastic | 2 | .24 |
| #3 | Min over-utilization of rubber | 1 | .12 |
| #4 | Min over-utilization of metal | 1 | .12 |
| #5 | Min over-utilization of budget | .5 | .05 |
| #6 | Min under-utilization of budget | .5 | .06 |
| #7 | Min under-utilization of labor | .5 | .06 |

**Decision Variables**:

Let,

X1, = Number of Tiny Tanks produced

X2 = Number of Tiny Trucks produced

X3 = Number of Tiny Turtles produced

Oi = Excess of a given goal, i

**Objective Function**:

Max Z = 1,000,000x1 + 200,000x2 + 300,000x3 + 400,000x4 + 450,000x5 + 450,000x6

s.t,

**Cost:**

**All non-zero constraints**:

Xi = 0, 1