**ncsu_logo**

**BUS 443 Business Analytics**

**Linear Programming Assignment 3**

**Acme Alarms: Make or Buy?**

A sudden increase in the demand for smoke detectors has left Acme Alarms with insufficient capacity to meet demand. The company has seen monthly demand from its retailers for its electronic and battery-operated detectors rise to 20,000 and 10,000, respectively. Acme’s production process involves three departments: fabrication, assembly, and shipping. The relevant quantitative data on production and prices are summarized as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Department** | **Monthly Hours Available** | **Hours/Unit (Electronic Detector)** | **Hours/Unit**  **(Battery-Operated Detector)** |
| Fabrication | 2000 | 0.15 | 0.10 |
| Assembly | 4200 | 0.20 | 0.20 |
| Shipping | 2500 | 0.10 | 0.15 |

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Electronic**  **Detector** | **Battery-Operated Detector** |
| Variable cost per unit |  | $18.80 | $16.00 |
| Retail Price per unit |  | $29.50 | $28.00 |

The company also has the option to obtain additional units from a subcontractor, who has offered to supply up to 20,000 units per month in any combination of electric and battery-operated models, at a charge of $21.50 per unit. For this price, the subcontractor will test and ship its models directly to the retailers without using Acme’s production process.

Open a new spreadsheet and create the model to solve this business question. Use the SUMPRODUCT function and structure below to assist you. What are the maximum profit and corresponding make/buy levels? (Fractional decisions are acceptable in the model, as these may be later rounded by the management.)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Decisions** |  |  |  |  |  |  | |  |
|  | *Emake* | *Bmake* | *Ebuy* | *Bbuy* |  |  | |  |
| Product mix |  |  |  |  |  |  | |  |
|  |  |  |  |  |  |  | |  |
| **Objective** |  |  |  |  | **Total Profit** | |  |  |
| Revenue | 29.50 | 28.00 | 29.50 | 28.00 |  |  | |  |
| Cost | 18.80 | 16.00 | 21.50 | 21.50 |  |  | |  |
| Profit |  |  |  |  |  |  | |  |
|  |  |  |  |  |  |  | |  |
| **Constraints** |  |  |  |  | LHS |  | | RHS |
| F-time | 0.15 | 0.1 | 0 | 0 |  | <= | | 2000 |
| A-time | 0.2 | 0.2 | 0 | 0 |  | <= | | 4200 |
| S-time | 0.1 | 0.15 | 0 | 0 |  | <= | | 2500 |
| E-dmd | 1 | 0 | 1 | 0 |  | <= | | 20000 |
| B-dmd | 0 | 1 | 0 | 1 |  | <= | | 10000 |
| Subcombination |  |  |  |  |  | <= | | 30000 |