Tots Toys makes a plastic tricycle that is composed of three major components: a handlebar-front wheel-pedal assembly, a seat and frame unit, and rear wheels. The company has orders for 12,000 of these trikes.

As indicated in the table below, the company obviously does not have the resources available to manufacture everything needed for the completion of 12000 tricycles, so it has arranged to purchase additional components, as necessary.

Develop a linear programming model to tell the company how many of each component should be manufactured and how many should be purchased in order to provide 12000 fully completed tricycles at the minimum cost.

(Hints: (1) there are three components, each of which can either be manufactured or purchased – this tells you how many decision variables there are. (2) There are three resources that are utilized when components are produced (not when they are purchased), which determines the set of resource constraints. (3) finally, we need constraints to ensure that we have adequate supplies of each of the three components, and as indicated, each component can be purchased or manufactured. Bear in mind that it may be cost effective to manufacture different percentages of each component.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  **Requirements** |  |  |  |  |
| Component | Plastic | Time | Space | Cost to Manufacture | Cost to Purchase |
| Front | 3 | 10 | 2 | 8 | 12 |
| Seat/Frame | 4 | 6 | 2 | 6 | 9 |
| Each rear wheel  | .5 | 2 | .1 | 1 | 3 |
|  **Available** | **50000** | **160000** | **30000** |  |  |

1. set up the problem (provide the objective function and set of constraints)
2. find the optimal solution using Management Scientist, Excel Solver.
3. list the values of the objective function and the decision variables in the optimal solution you’ve found.

 a. **FM = Fronts Manufactured**

 **SM = Seats Manufactured**

 **WM = Wheels Manufactured**

 **FP = Fronts Purchased**

 **SP = Seats Purchased**

 **WP = Wheels Purchased**

 **Min 8FM + 6SM + 1WM + 12FP + 9SP + 3WP**

 **s.t. 3FM + 4SM + .5WM < 50000**

 **10FM + 6SM + 2WM < 160000**

 **2FM + 2SM + .1WM < 30000**

 **FM + FP ≥ 12000**

 **SM + SP ≥ 12000**

 **WM + WP ≥ 24000**

 **FM, SM, WM, FP, SP, WP ≥ 0**