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 first 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.

Regarding the outsourcing option, the company can purchase components from one of two suppliers. Supplier A charges a dollar less per component than Supplier B, as indicated in the second table. However, there are limits to the number of components that are available from Supplier A:

up to 5,000 handlebar-front wheel-pedal assemblies

up to 5,000 seat and frame units

up to 10,000 rear wheels

Develop a linear programming model to tell the company how many of each component should be manufactured and how many should be purchased from each supplier in order to provide 12000 fully completed tricycles at the minimum cost. (Don’t forget that there are TWO rear wheels per trike)

(Hints: (1) there are three components, each of which can either be manufactured or purchased from one of two sources – 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) we need constraints to ensure that we have adequate supplies of each of the three components, and as indicated, each component can be purchased from one of two sources or manufactured. Bear in mind that it may be cost effective to manufacture different percentages of each component. (4) There are limits to how many components of each type that we can purchase from supplier A.

|  |  |  |  |
| --- | --- | --- | --- |
| In-house manufacturing: | **Requirements** |  |  |
| Component | Plastic | Time | Space |
| Front | 3 | 10 | 2 |
| Seat/Frame | 4 | 6 | 2 |
| Each rear wheel | .5 | 2 | .1 |
| **Available** | **50000** | **160000** | **30000** |

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  | Cost to Manufacture | Cost to Purchase from Supplier A | Cost to Purchase from Supplier B |
| Front | 8 | 12 | 13 |
| Seat/Frame | 6 | 9 | 10 |
| Rear Wheel | 1 | 3 | 4 |

For the problem:

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