**Problem: Automobile manufacturer to meet next 2 months demand and avg mileage of 23 mpg for trucks and cars by minimising the cost** given production and available steel constraints

**Solution**: Find **maximum no of units of trucks and cars** that should be produced to meet the **monthly demand and mileage requirements** with **minimum production cost for the company**

**Inputs**: in blue in spreadsheet

* **For each month**
  + Maximum total available production for vehicles (trucks + cars)
  + **Demand for trucks and cars**
  + Maximum steel available in ton’s
  + $ Cost/ ton for steel
  + $ Holding cost/vehicle
* Starting inventory for trucks and cars
* Mileage in mpg for trucks and cars
* **Average mileage required 23 mpg**

**Objective function** = **Min ($ Total Cost) = ,** where

* **Yi** – $ Total cost of steel used per month
* **Zi** – $ Total inventory holding cost per month
* **i (1,2)** for the two months
* **Yi = (SCi \* TSUi),** where
  + **SC** – $ Steel cost / ton for month i, (700,800)
  + **TSU** – Total Steel Used in month i
  + **TSUi =** 
    - **Xij - units of vehicle j to be produced for month i**
    - **SUPV** – Steel Used Per Vehicle j in ton’s, (2,1)
    - j (trucks, cars)
* **Zi = HCi \* EIi**, where
  + **HC** – $ Holding Cost/vehicle for ending inventory for month i, (200,200)
  + **EI** – Ending Inventory for month i
  + **EIi = IAPi – Di**
    - **IAP** – Inventory After Production for month i
    - **D – Demand for month i**
  + **IAPi = Xi + OIi**
    - **X** – Total vehicles (trucks + cars) produced in month i
    - **OI** – Opening Inventory for month i **=** starting inventory or EIi-1

**Decision variable**: **Xij** – units of vehicle j to be produced for month i. j (trucks, cars), i (1,2)

**Constraints**:

1. **<= MTAVi**

* MTAVi = Maximum Total Available Vehicle production for month i (1000, 1000)

1. **Xij** must be integer values
2. **IAPij >= Dij**
   * IAPij = Inventory After Production for vehicle j in month i
   * Dij = Demand for vehicle j in month i
3. **EIij >=0**
   * Ending Inventory for vehicle j in month i, should be >= 0 to ensure we meet demand for each vehicle in each month
4. **TSUi <= MSAi**
   * MSAi – Monthly Steel Available to purchase in month i
5. **>=** 
   * Total vehicle mileage per month >= total minimum vehicle mileage per month
   * **VMj** – Vehicle Mileage in mpg for vehicle j (15, 35)
   * **AVMR** – Average Vehicle Mileage Required = 23 mpg

**Result**:

* The automobile manufacturer should **produce (400, 600) and (200, 300) units of (trucks, cars)** to **meet month (1,2) demand** and **average mileage requirement of 23 mpg** with **minimum Cost** = **$1,560,000**

**Problem: Use SolverTable to do sensitivity analysis** on **Total Cost** by **varying** the **minimum avg mileage requirement** of 23 mpg from 20 to 30 in 0.5 increments. What happens when it is greater than 27 mpg

**Solution**: Vary **avg mileage required as input** (in increments of 0.5 from 20 to 30) and see the results by observing **output cells of Xij and Minimum Total Cost in SolverTable**

**Result:**

* The results of sensitivity analysis are in STS\_2 sheet. It shows that by varying avg mileage,
* There is **no impact on Total Cost from 20 to 27 mpg** as avg mileage
  + It stays constant at $1,560,000, as total vehicles produced is constant at 1,500
  + So, there is no sensitivity to cost from 20 - 27 mpg
* **From 27.5 – 29.0 mpg mileage, the Total Cost of production keeps increasing**
  + As total vehicles produced start increasing beyond 1,500, to meet minimum monthly mileage requirement
* **From 29.5 – 30.0 mpg mileage**, there is **no feasible solution** as it **most likely exceeds** the Total Maximum Available Vehicle production for both months (2000)