Network Flows Modeling (NF)

→ Graphical type of modeling.

NO explicit variables or equations.

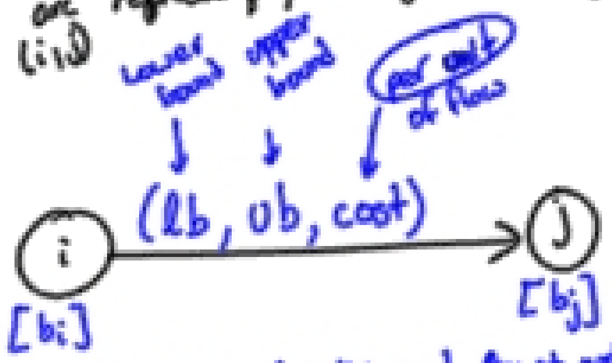
- IP → can solve problems with ≈ 1000's variables
- LP → can solve problems will millions of variables
- NF
  - → can solve almost any size of problem (and much faster than solving LP)
  - → solutions are garanteed to be integer (is the data is integer)

NF model is a network with nodes and arcs and some information on them.

NODE

- Facilities
- Locations
- Objects
- Decision points

arc (i,j) represent the possibility of sending flow from i to j (eg. units of a product)



- if $b_i > 0$ then it is the supply flow at node i
- if $b_i < 0$ then it is the demand at node j
- if $b_i = 0$ then the node has no supply or demand and it is simply a "transhipment" node.

$$\boxed{\sum \text{supply} = \sum \text{-demands}}$$

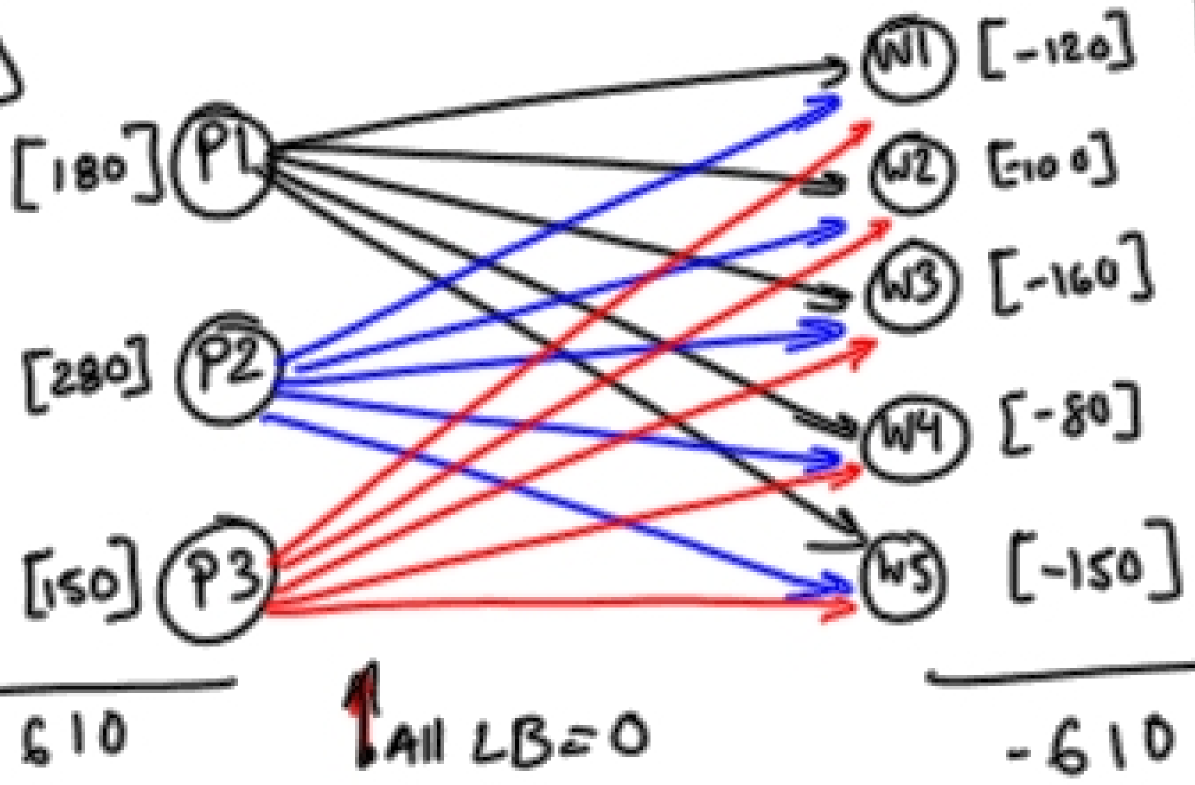
you must make sure that this is the case otherwise your model is wrong

- Decisions in NF (what the computer will tell you after solving the model) is the amount of flow through each arc
- Objective: "Always" to minimize the total cost.
  [Therefore costs are always positive numbers in my network and profits or revenues are negative numbers]
- Constraints (what the computer will always make sure that is satisfied by the flow):
  1) [all flow into a node + supply/demand at this node = all flow out of this node] for each and every node
  2) flow is between the LB and UB of every arc
     (LB = lower bound, UB = upper bound)

$\sum$supply $= \sum$-demand

Transportation Problem

$\boxed{1}$



- All LB = 0
- All UB = ∞
- costs as given in the table.

Transportation models

- Network is bipartite

- All LB = 0
- All UB = ∞

we don't even need to write them.

$\boxed{\sum \text{supply} = -\sum \text{demand}}$

- All arcs go from supply nodes to demand nodes.