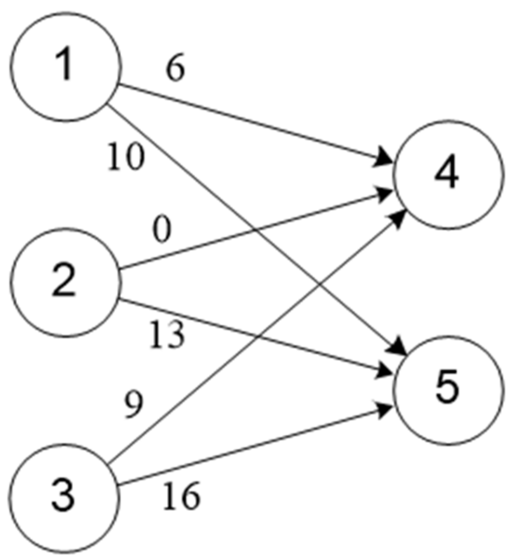
Networks 1: Assignment and Transportation Problems

- Linear assignment problem (LAP) special case of transportation problem
- Special procedures more efficient than LP were developed to solve LAP and transportation problems
  - e.g., Hungarian method
- Now usually easier to transform into LP since solvers are so
  - Special, very efficient procedures only used for shortest path problem (Dijkstra)

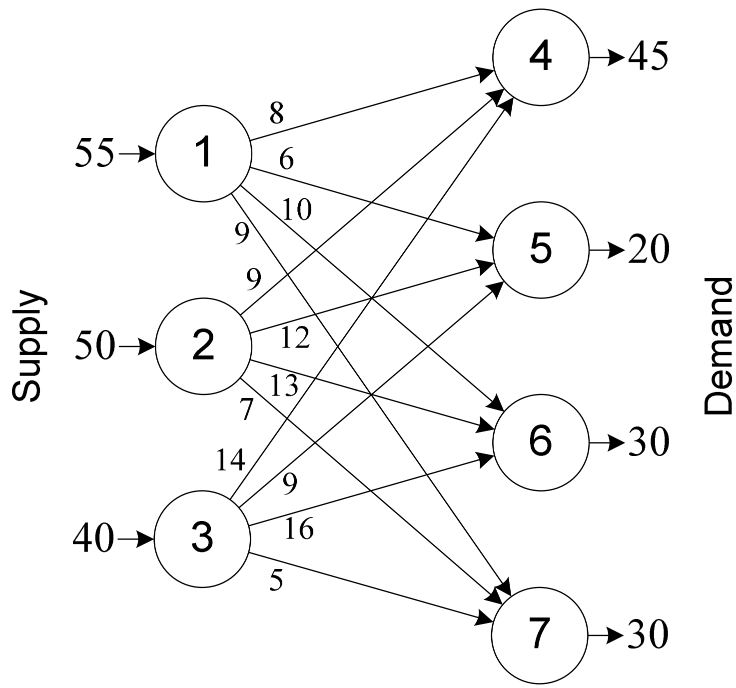
Linear Assignment Problem

- Find least cost set of arcs that connect each destination node with a source node
  - Also called matching problem on a weighted bipartite graph
  - Quadratic assignment problem is when cost of an assignment depends on the other assignments (more difficult to solve)



Transportation Problem

- Satisfy node demand from supply nodes
  - Can be used for allocation in ALA when NFs have capacity constraints
  - Min cost/distance allocation ⇔ infinite supply at each node



Trans	4	5	6	7	Supply
1	8	6	10	9	55
2	9	12	13	7	50
3	14	9	16	5	40
Demand	45	20	30	30	

Greedy Solution Procedure

- Procedure for transportation problem: *Continue to select lowest cost supply until all demand is satisfied*
  - Fast, but not always optimal for transportation problem
  - Dijkstra's shortest path and simplex method for LP are optimal greedy procedures

Trans	4	5	6	7	Supply	
1	(8)	(6)	10	9	55	-20 = 35 -35 = 0
2	(9)	12	(13)	7	50	-10 = 40 -30 = 10
3	14	9	16	(5)	40	-30 = 10
Demand	~~45~~	~~20~~	~~30~~	~~30~~		
	~~10~~ 0	0	0	0		

$$TC_{\text{greedy}} = 5(30) + 6(20) + 8(35) + 9(10) + 13(30) = 1,030$$

$$TC_{\text{optimal}} = 5(30) + 6(20) + 8(5) + 9(40) + 10(30) = 970$$