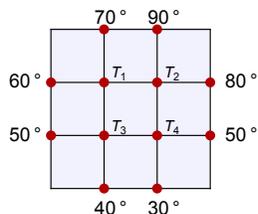


## 1.6 Applications of Linear Systems

### Heat Transfer

**Example 1** The following shows a metal plate and some sample external temperatures. Assuming the temperature at each interior point is an average of the nearest four temperatures to that point, estimate the temperature at the four interior locations.



### Leontief Input-Output Model

**Example 2** Suppose an economy has four sectors, Agriculture (A), Energy (E), Manufacturing (M), and Transportation (T). Sector A sells 10% of its output to E and 25% to M and retains the rest. Sector E sells 30% of its output to A, 35% to M, 25% to T, and retains the rest. Sector M sells 30% of its output to A, 15% to E, 40% to T and retains the rest. Sector T sells 20% of its output to A, 10% to E, 30% to M and retains the rest.

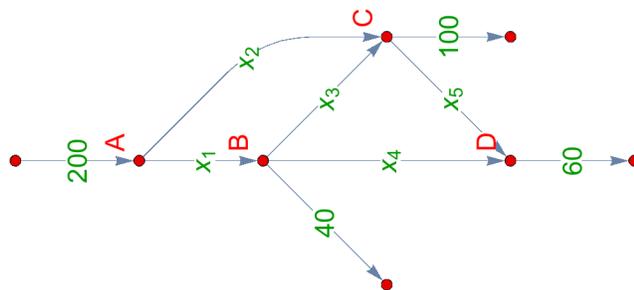
- Make a network graph of the exchange of goods and services.
- Construct an exchange table for this economy.
- Find a set of equilibrium prices for the economy.

**Example 4** Balance the chemical equation:



## Network Flow

**Example 5** When modeling a network of roads, the number of vehicles *entering* an intersection (or node) must be equal to the number *leaving* the intersection. Also, total flow into the network must be equal to the flow out of the network. The following (rotated) graph is *Mathematica's* rendering for a directed network.



- Find the general traffic pattern in the freeway network shown in the figure. (Flow rates are in cars/min.)
- Describe the general traffic pattern when the road flow  $x_4$  is closed.
- When  $x_4 = 0$ , what is the minimum value of  $x_1$ ?