

Air Force transportation problem

The Air Force wants to introduce a new shielding material for its B-52 planes. An initial test phase will involve planes at five bases: March (CA), Davis (AZ), McConnell (KS), Pinecastle (FL) and McDill (FL). Supplies are available at three depots: Columbus (OH), Oklahoma City (OK), Macon (GA). The distance between depots and bases (in miles) is shown in the table below, together with the number of tons of the material needed at each base and available at each depot (shown in parentheses by each location). See Figure 5 for a map.

	McDill	March	Davis	McConnell	Pinecastle
	(3)	(5)	(5)	(5)	(3)
OK City (8)	938	1030	824	136	995
Macon (5)	346	1818	1416	806	296
Columbus (8)	905	1795	1590	716	854

Solving the LP

A first guess: It seems sensible to make use of the proximity of McConnell to Oklahoma, and of Pinecastle and McDill to Macon. Sending as much as possible from each depots to the closest bases (referred to as a *greedy* approach) leads to the solution shown in Figure 6:

$$x_{13} = 3, x_{14} = 5, x_{21} = 2, x_{25} = 3, x_{31} = 1, x_{32} = 5, x_{33} = 2,$$

with all other $x_{ij} = 0$. This leads to a total of 17,792 ton-miles.

The optimal solution: The following is the actual optimal:

$$x_{12} = 3, x_{13} = 5, x_{21} = 3, x_{25} = 2, x_{32} = 2, x_{34} = 5, x_{35} = 1,$$

with all other $x_{ij} = 0$. This leads to a total of 16,864 ton-miles. (See Figure 7). Note that although this solution eliminates completely the short leg from OK City to McConnell, it more than halves the tonnage on the longest possible leg, Columbus to March.