It is, however, politically unacceptable to allow a certain price index to rise. As a result of the way this index is calculated, this limitation simply demands that the new prices must be such that the total cost of last year's consumption would not be increased. A particularly important additional requirement is to quantify the economic cost of this political limitation.

12.22 Efficiency analysis

A car manufacturer wants to evaluate the efficiencies of different garages, who have received a franchise to sell its cars. The method to be used is data envelopment analysis (DEA). References to this technique are given in Section 3.2. Each garage has a certain number of measurable 'inputs'. These are taken to be *Staff*, *Showroom Space*, *Catchment Population* in different economic categories and annual *Enquiries* for different brands of car. Each garage also has a certain number of measurable 'outputs'. These are taken to be *Number Sold* of different brands of car and annual *Profit*. Table 12.15 gives the inputs and outputs for each of the 28 franchised garages.

A central assumption of DEA (although modified models can be built to alter this assumption) is that constant returns to scale are possible, that is, doubling a garage's inputs should lead to a doubling of all its outputs. A garage is deemed to be efficient if it is not possible to find a mixture of proportions of other garages, whose combined inputs do not exceed those of the garage being considered, but whose outputs are equal to, or exceed, those of the garage. Should this not be possible then the garage is deemed to be inefficient and the comparator garages can be identified.

A linear programming model can be built to identify efficient and inefficient garages and their comparators.

12.23 Milk collection

A small milk processing company is committed to collecting milk from 20 farms and taking it back to the depot for processing. The company has one tanker lorry with a capacity for carrying 80 000 litres of milk. Eleven of the farms are small and need a collection only every other day. The other nine farms need a collection every day. The positions of the farms in relation to the depot (numbered 1) are given in Table 12.16 together with their collection requirements.

Find the optimal route for the tanker lorry on each day, bearing in mind that it has to (i) visit all the 'every day' farms, (ii) visit some of the 'every other day' farms and (iii) work within its capacity. On alternate days, it must again visit the 'every day' farms and also visit the 'every other day' farms not visited on the previous day.

For convenience, a map of the area considered is given in Figure 12.7.

Table 12.16

Farm	Position 10 miles		Collection frequency	Collection requirement (1000 l)
	East	North		
1 (Depot)	0	0	–	–
2	−3	3	Every day	5
3	1	11	Every day	4
4	4	7	Every day	3
5	−5	9	Every day	6
6	−5	−2	Every day	7
7	−4	−7	Every day	3
8	6	0	Every day	4
9	3	−6	Every day	6
10	−1	−3	Every day	5
11	0	−6	Every other day	4
12	6	4	Every other day	7
13	2	5	Every other day	3
14	−2	8	Every other day	4
15	6	10	Every other day	5
16	1	8	Every other day	6
17	−3	1	Every other day	8
18	−6	5	Every other day	5
19	2	9	Every other day	7
20	−6	−5	Every other day	6
21	5	−4	Every other day	6

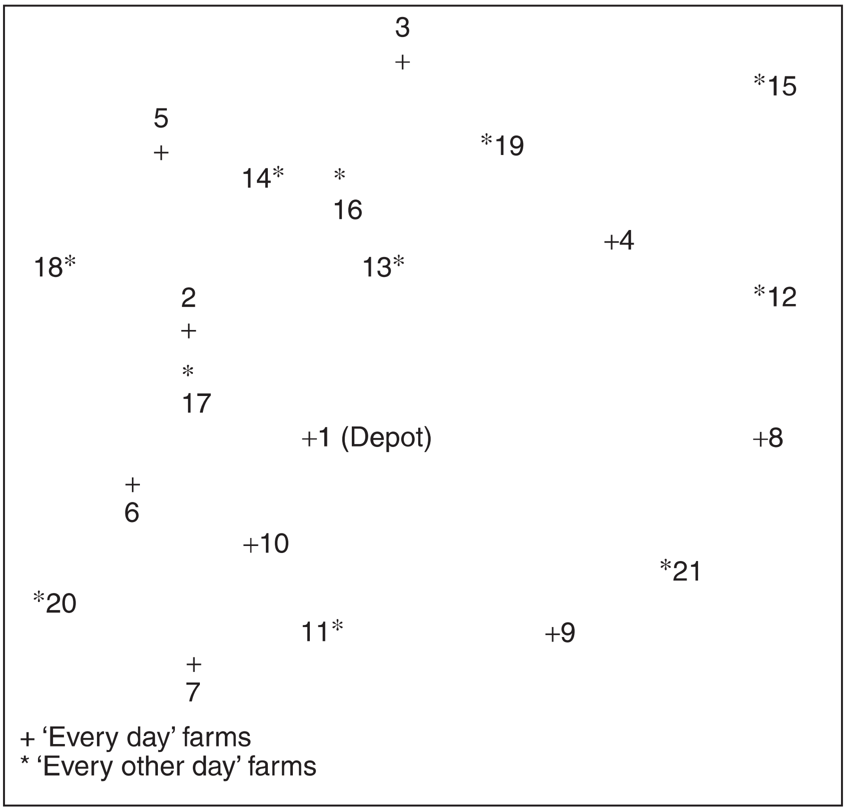

Figure 12.7