14.25 Car rental

The numbers of cars in all aspects of the following solution have been rounded from the fractional answers that result from the linear programming model.

The company should own 624 cars and pursue the following policies that will result in a weekly profit of £122 398.

The estimated number of undamaged cars in each depot at the beginning of each day will be as follows (there will also be hired out cars not in any depot).

	Glasgow	Manchester	Birmingham	Plymouth
Monday	68	99	145	46
Tuesday	66	94	154	39
Wednesday	70	100	125	47
Thursday	69	115	117	44
Friday	71	102	126	44
Saturday	65	96	154	73

The estimated number of damaged cars in each depot at the beginning of each day will be as follows.

	Glasgow	Manchester	Birmingham	Plymouth
Monday	11	12	20	6
Tuesday	7	12	20	4
Wednesday	8	12	20	6
Thursday	9	12	20	5
Friday	11	12	20	5
Saturday	7	12	22	3

Of the undamaged cars, the following should be rented out each day, for the periods and destinations in the proportions given in the statement of the problem.

	Glasgow	Manchester	Birmingham	Plymouth
Monday	68	99	95	46
Tuesday	66	94	154	39
Wednesday	70	80	125	47
Thursday	69	115	111	44
Friday	71	102	70	0
Saturday	65	93	124	73

No transfers of undamaged cars should be made but the following transfers of damaged cars should be made (arriving the following day).

Glasgow to Manchester

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
3	2	3	2	3	2

Glasgow to Birmingham

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
5	5	3	4	9	5

Plymouth to Birmingham

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
5	3	6	5	5	3

The two repair depots of Manchester and Birmingham are fully occupied on all six days repairing 12 and 20 cars, respectively, each day. Repair capacity is clearly a limiting factor on the operation of the company. This is reflected by the high-shadow prices on the repair capacity constraints, which vary between £617 and £646 per car per day in both repairing depots. A plan to increase repair capacity forms the subject of problem 12.27. The solution above was obtained in 153 iterations.

14.26 Car rental 2

Only the Birmingham repair capacity should be increased, using both expansion options, to expand to 22 cars per day. Repair capacities in all depots are again fully used.

This allows the company to expand its fleet to 895 cars, resulting in a new weekly profit of £135 511. All demands still cannot be fully met.

This model solved in 5 nodes.

14.27 Lost baggage distribution

Two vans are needed. Solving the model, defined in Section 13.27 (a relaxation of the final model), leads to the 'solution' given in Figure 14.10. This required 2263 nodes to solve.