

- (c) Suppose that the unit cost at each plant were \$10 higher than the original figure. What change in the optimal distribution plan would result? What if the plant costs were \$20 higher?

**3.5 Repositioning Supply:** The American Rent-a-Car Company has eight outlets in a metropolitan area. American operates under a policy that calls for a specific "target" percentage of all available cars to be located at each outlet at the start of each day. These percentages are summarized in the following table.

Outlet	1	2	3	4	5	6	7	8
Percentage	20	10	20	5	10	20	5	10

For example, if 50 cars are available, 10 should be at outlet 1 at the start of the day. At the end of a day, if the current distribution of cars does not comply with the targets, American employees drive the cars overnight from outlet to outlet so that the new distribution meets the specified targets. The distance between each pair of outlets is given in the following table.

		To Outlet							
		1	2	3	4	5	6	7	8
From Outlet	1	—	8	6	7	3	5	4	2
	2	8	—	6	5	8	4	6	7
	3	6	6	—	8	3	4	7	4
	4	7	5	8	—	9	5	3	7
	5	3	8	3	9	—	5	6	2
	6	5	4	4	5	5	—	3	3
	7	4	6	7	3	6	3	—	4
	8	2	7	4	7	2	3	4	—

At the end of a particular day, American finds that the 100 cars currently available are distributed at the outlets as follows.

Outlet	1	2	3	4	5	6	7	8
Cars	4	14	5	17	22	7	10	21

- (a) Given this distribution of cars, find a schedule for minimizing the total distance traveled during the overnight redistribution of the cars.
- (b) Show the network diagram corresponding to the solution in (a). That is, label each of the arcs in the solution and verify that the flows are consistent with the given information.
- 3.6 Assigning Tasks:** A data processing department wishes to assign five programmers to five programming tasks (one programmer to each task). Management has estimated the total number of days each programmer would take if assigned to the different jobs, and these estimates are summarized in the following table.

	Task	1	2	3	4	5
Programmer	1	50	25	78	64	60
	2	43	30	70	56	72
	3	60	28	80	66	68
	4	54	29	75	60	70
	5	45	32	70	62	75

- (a) Determine the assignment that minimizes the total programmer days required to complete all five jobs.
- (b) Show the network diagram corresponding to the solution in (a). That is, label each of the arcs in the solution and verify that the flows are consistent with the given information.
- (c) How would the solution change if programmer 3 could not be assigned to tasks 2 or 4?

**3.7 Distributing Oil:** Texxon Oil Distributors, Inc., has three active oil wells in a west Texas oil field. Well 1 has a capacity of 93 thousand barrels per day (TBD), Well 2 can produce 88 TBD, and Well 3 can produce 95 TBD. The company has five refineries along the Gulf Coast, all of which have been operating at stable demand levels. In addition, three pump stations have been built to move the oil along the pipelines from the wells to the refineries. Oil can flow from any one of the wells to any of the pump stations and from any one of the pump stations to any of the refineries, and Texxon is looking for a minimum-cost schedule. The refineries' requirements are as follows.

Refinery	R1	R2	R3	R4	R5
Requirement (TBD)	30	57	48	91	48

The company's cost accounting system recognizes charges by the segment of pipeline that is used. These daily costs are given in the tables below, in dollars per thousand barrels.

To		Pump A	Pump B	Pump C
From	Well 1	1.52	1.60	1.40
	Well 2	1.70	1.63	1.55
	Well 3	1.45	1.57	1.30

To		R1	R2	R3	R4	R5
From	Pump A	5.15	5.69	6.13	5.63	5.80
	Pump B	5.12	5.47	6.05	6.12	5.71
	Pump C	5.32	6.16	6.25	6.17	5.87

- (a) What is the minimum cost of providing oil to the refineries? Which wells are used to capacity in the optimal schedule?