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GSA industries produces four models of prefabricated housing units in each of two locations: one in El Cajon, California, the other in Elkhart, Indiana. The manufactured houses are transported to regional distribution centers in Phoenix, Nashville, and Miami. Because of current economic conditions, GSA is able to sell all the units it manufactures during the year. The following table gives the outstanding orders for the years as well as the production plan GSA has approved for the Elkhart, Indiana plant.

**Orders And Production Quantities
At Elkhart, Indiana**

	Model			
	Picket Fence	Town House	Gentle Stream	El Presidente
Phoenix	50	60	60	90
Nashville	80	60	30	20
Miami	75	90	85	90
Production at Elkhart Plant	100	75	75	120

The El Cajon plant is being reconfigured for this year's models. The plant consists of four separate buildings, each of which will produce a different model. The number of prefabricated houses that can be produced in a building depends on many factors, including the size and the shape of the building and existing production facilities. The accompanying table gives the estimated production quantities of each model.

For example, if Building 1 is used to produce the Picket Fence Model, 30 such models can be produced; if it is used to produce the Town House Model, 25 such models can be produced, and so on. Because of the design of Building 3, no El Presidente models can be produced in Building 3.

Production Levels

	Model			
	Picket Fence	Town House	Gentle Stream	El Presidente
Building 1	30	25	20	10
Building 2	60	55	50	45
Building 3	40	35	30	N/A
Building 4	95	85	See Text	65

These production quantities were determined by analyzing the rate at which various subassemblies can be manufactured and passed along to the next operation. The production of the subassemblies have constraining capacities. A network representation for the Gentle Stream model in Building 4 is shown above.

The gross profit per unit (excluding transportation costs and fixed labor and overhead cost) for GSA are given in the following table.

Gross Profit Per Unit

Model	Gross Profit
Picket Fence	\$ 9.600
Town House	\$11.520
Gentle Stream	\$15.360
El Presidente	\$19.200

Unit transportation charges from either the Elkhart, Indiana, plant or the El Cajon plant are independent of the model shipped. Thus, each model has exactly the same transportation cost between a particular pair of cities. The following unit transportation costs have been determined for the Elkhart, Indiana, plant.

**Unit Transportation Costs
From Elkhart, Indiana**

To	Cost
Phoenix	\$1.450
Nashville	\$ 725
Miami	\$2.500

The unit transportation costs from El Cajon depend on the mode and time of transportation. Various truck, rail, and boat routes are available under contract to GSA. These are summarized in the following table. The cost of changing modes of transportation at a city (rail to truck, truck to rail or truck to ship) is \$250 per vehicle.

Shipping Routes

From	To	No. of Days	Cost/day
Truck Routes			
El Cajon	Phoenix	1	\$375
El Cajon	Dallas	3	\$300
Phoenix	Rapid City	2	\$250
Phoenix	Oklahoma City	2	\$175
Dallas	New Orleans	1	\$300
Rapid City	Chicago	3	\$325
Rapid City	Oklahoma City	2	\$250
Rapid City	Nashville	4	\$200
Chicago	Nashville	2	\$300
Chicago	Raleigh	3	\$375
Oklahoma City	New Orleans	3	\$225
Oklahoma City	Nashville	4	\$300
Oklahoma City	Raleigh	5	\$200
Nashville	Miami	3	\$350
Raleigh	Miami	4	\$250
Rail Routes			
El Cajon	Phoenix	2	\$250
El Cajon	Dallas	4	\$350
Phoenix	Rapid City	3	\$175
Chicago	Nashville	3	\$200
Chicago	Raleigh	4	\$225
Oklahoma City	Raleigh	3	\$250
Raleigh	Miami	3	\$300
Boat Routes			
New Orleans	Miami	4	\$400

Fixed labor costs at both plants combined are expected to be \$3 million; other overhead is estimated to be \$2 million.

Prepare a report for GSA that analyzes the El Cajon operation in light of previous commitments at Elkhart, Indiana, plant, Analyze:

- 1.The maximum production capacity of the Gentle Stream model at Building 4 in El Cajon.
- 2.Which building should produce which model at the El Cajon plant in order to maximize gross profit. (Ignore transportation costs in this analysis and discuss why this is probably valid with particular set of data. Discuss how the model would change if it were not valid.)
- 3.The minimal total transportation costs from El Cajon to each of the distribution cities. (Discuss any time implications of your recommendation.)
- 4.The allocation of each housing model from each production city to each distribution city.
- 5.The net profit for the company for the year.