



Case 4 Integer Programming Formulation

1. (Revised from Hillier) The Good Products Company can produce three products in two plants. The processing time for each product in each plant and its corresponding profit and demand is given in the table below. However due to budget constraints management has only decided to produce at most two products and only operate one plant. Formulate the ILP that will maximize Good Products' profit.

	Production Time Used for Each Unit Produced			Available Production time per week
	Product 1	Product 2	Product 3	
Plant 1	3 hours	4 hours	2 hours	30 hours
Plant 2	4 hours	6 hours	2 hours	40 hours
Profit	5	7	3	(thousands of dollars)
Max Demand	7	5	9	(units per week)

2. (Revised from Hillier) The board of directors of General Wheels Co. is considering seven large capital investments. Each investment can be made only once. These investments differ in the estimated long-run profit (net present value) that they will generate as well as in the amount of capital required, as shown by the following table (in units of millions of dollars). The total amount of capital for these investments ie \$100 million. Develop the LP given the following constraints (note: treat each item independent from each other, unless specified)

	Investment Opportunity						
	1	2	3	4	5	6	7
Estimated Profit	17	10	15	19	7	13	9
Capital required	43	28	34	48	17	32	23

- Investments 1 and 2 are mutually exclusive, and so are investments 3 and 4.
- In addition to (a) Investments 3 and 4 cannot be undertaken unless one of the first two opportunities is undertaken
- We can only invest in at most 5 opportunities
- If investment 5 is undertaken, at least one of investment 6 or 7 must be undertaken.
- If investment 6 is undertaken, investment 7 is automatically undertaken.

3. (Winston) Eastinghouse sells air conditioners. The annual demand for air conditioners in each region of the country is as follows: East, 100,000; South, 150,000; Midwest, 110,000; West, 90,000. Eastinghouse is considering building the air conditioners in four different cities: New York, Atlanta, Chicago, and Los Angeles. The cost of producing an air conditioner in a city and shipping it to a region of the country is given in the table. Any factory can produce as many as 150,000 air conditioners per year. The annual fixed cost of operating a factory in each city is can be seen in the given table. At least 50,000 units of the Midwest demand for air conditioners must come from New York, or at least 50,000 units of the Midwest demand must come from Atlanta. Formulate an IP whose solution will tell Eastinghouse how to minimize the annual cost of meeting demand for air conditioners.

City	Annual Fixed Cost (\$ Million)	Price by Region (\$)			
		East	South	Midwest	West
New York	6	206	225	230	290
Atlanta	5.5	225	206	221	270
Chicago	5.8	230	221	208	262
Los Angeles	6.2	290	270	262	215

must come from New York, or at least 50,000 units of the Midwest demand must come from Atlanta. Formulate an IP whose solution will tell Eastinghouse how to minimize the annual cost of meeting demand for air conditioners.