

## ALY 6050 Project 5

### Problem 1

Klein Industries manufactures three types of portable air compressors: small, medium, and large, which have unit profits of \$20.50, \$34.00, and \$42.00, respectively. The projected monthly sales are:

Monthly Sales	Small	Medium	Large
Minimum	14000	6200	2600
Maximum	21000	12500	4200

The production process consists of three primary activities: bending and forming, welding, and painting. The amount of time in minutes needed to process each product in each department is

shown below:

Time Required	Small	Medium	Large	Available Time
Bending/forming	0.4	0.7	0.8	23400
Welding	0.6	1	1.2	23400
Painting	1.4	2.6	3.1	46800

How many of each type of air compressor should the company produce to maximize profit? Formulate and solve a linear optimization model.

Use the following notation:

$S$ : units of small tanks produced

$M$ : units of medium tanks produced

$L$ : units of large tanks produced

### Problem 2

Shafer Office Supplies has four distribution centers located in Atlanta, Cincinnati, Chicago, and Salt Lake City, and ships to 12 retail stores located in different cities. The company wants to minimize the monthly transportation cost of shipping one of its higher volume products, boxes of standard copy paper. The per-unit shipping cost from each distribution center to each retail location and the amounts currently in inventory and ordered at each retail location are shown in the table below. Develop and solve an optimization model to minimize the total transportation cost and answer the following questions. Use the sensitivity report to answer as appropriate to answer questions c and d.

	Seattle	San Francisco	Las Vegas	Tucson	Denver	Charlotte
Atlanta	\$ 2.15	\$2.10	\$1.75	\$ 1.50	\$ 1.20	\$0.65
Lexington	\$ 1.95	\$2.00	\$1.70	\$ 1.53	\$ 1.10	\$0.55
Milwaukee	\$ 1.70	\$1.85	\$1.50	\$ 1.41	\$ 0.95	\$0.40
Salt Lake City	\$ 0.60	\$0.55	\$0.35	\$ 0.60	\$ 0.40	\$0.95
Demand	5000	16000	4200	3700	4500	7500

	Minneapolis	Fayetteville	Birmingham	Orlando	Cleveland	Philadelphia	Supply
Atlanta	\$0.90	\$0.80	\$0.35	\$0.15	\$0.60	\$0.50	40000
Lexington	\$0.60	\$1.05	\$0.60	\$0.50	\$0.25	\$0.30	35000
Milwaukee	\$0.40	\$0.95	\$0.70	\$0.70	\$0.35	\$0.40	15000
Salt Lake City	\$1.00	\$1.10	\$1.35	\$1.60	\$1.60	\$1.70	16000
Demand	3000	9000	3300	12000	9500	16000	

- What is the minimum monthly cost of shipping?
- Which plants will operate at capacity in this solution?
- Suppose that 500 units of extra supply are available (and that the cost of this extra capacity is a sunk cost). To which plant should this extra supply go, and why?
- Suppose that the per-unit cost of shipping from Atlanta to Birmingham increased by an additional \$0.3. Without re-solving the problem, would that optimal solution change?