

### Linear Programming

Some examples:

Giapetto's Woodcarving, Inc., manufactures two types of wooden toys: soldiers and trains. A soldier sells for \$27 and uses \$10 worth of raw materials. Each soldier that is manufactured increases Giapetto's variable labor and overhead costs by \$14. A train sells for \$21 and uses \$9 worth of raw materials. Each train built increase Giapetto's variable labor and overhead costs by \$10. The manufacture of wooden soldiers and trains requires two types of skilled labor: carpentry and finishing. A soldier requires 2 hours of finishing labor and 1 hour of carpentry labor. A train requires 1 hour of finishing labor and 1 hour of carpentry labor. Each week, Giapetto can obtain all the needed raw material but only 100 finishing hours and 80 carpentry hours. Demand for trains is unlimited, but at most 40 soldiers are bought each week. Giapetto wishes to maximize weekly profit (revenues - costs). Formulate a Linear Programming model of Giapetto's situation that can be used to maximize Giapetto's weekly profit.

U.S. Labs manufactures mechanical heart valves from the heart valves of pigs. Different heart operations require valves of different sizes. U.S. Labs purchases pig valves from three different suppliers. The cost and size mix of the valves purchased from each supplier are given in the Table below. Each month, U.S. Labs places one order with each supplier. At least 500 large, 300 medium, and 300 small valves must be purchased each month. Because of limited availability of pig valves, at most 500 valves per month can be purchased from each supplier. Formulate an LP that can be used to minimize the cost of acquiring the needed valves.

	Cost (in dollars) Per Valve	Percent Large	Percent Medium	Percent Small
Supplier 1	5	40	40	20
Supplier 2	4	30	35	35
Supplier 3	3	20	20	60

Sunco Oil manufactures three types of gasoline (gas 1, gas 2, gas 3).

- Each type of gasoline is produced by blending together three types of crude oil (crude 1, crude 2, crude 3).
- Sunco can purchase up to 5000 barrels of each type of crude oil daily.

	Sales Price Per Barrel		Purchase Price Per Barrel
Gas 1	\$70	Crude 1	\$45
Gas 2	\$60	Crude 2	\$35
Gas 3	\$50	Crude 3	\$25

- The crude oil blended to form gas 1 must have an average octane rating of at least 10 and contain at most 1% sulfur.
- The crude oil blended to form gas 2 must have an average octane rating of at least 8 and contain at most 2% sulfur.
- The crude oil blended to form gas 3 must have an average octane rating of at least 6 and contain at most 1% sulfur.

	Octane Rating	Sulfur Content
Crude 1	12	0.5%
Crude 2	6	2%
Crude 3	8	3%