Inspection Problem

A company has two grades of inspectors, 1 and 2, who are assigned for a quality control inspection. It is required that at least 1800 pieces be inspected per 8 hours day. Grade 1 inspectors check pieces at a rate of 25 per hour, with an accuracy of 98%. Grade 2 inspectors check pieces at a rate of 15 pieces per hour, with an accuracy of 95%.

The wage rate for a Grade 1 inspector is $4 per hour, while that of a Grade 2 inspector is $3 per hour. Each time an error is made by an inspecto, the cost to the company is $2. The company has 8 Grade 1 and 10 Grade 2 inspectors available for the job. The company wants to determine an optimal assignment of inspectors which will minimize the total cost of the inspection.

An Allocation Problem

A frequent problem in industry is to determine the most profitable utilization of certain resources which are in limited supply. Linear programming is ideally suited for the solution of these problems. In order to show the effectiveness of this approach, we shall hypothesize a situation which mirrors actuality in its essentials. The dimensions of the problem have been reduced to triviality, but it should be understood that the technique of solution applies with equal facility to problems of more realistic dimensions.

We imagine a manufacturer of electronic devices who markets two measuring instruments, X and Y, at $12 and $15, respectively. The instruments are similar in design and differ only in the numbers of various components which are needed for their assembly. The Bills of Materials for the two instruments are as follows:

Product	**X**	**Y**
Component a	6 per unit	2 per unit
Component b	15 per unit	12 per unit
Component c	4 per unit	10 per unit
Component d	3 per unit	5 per unit

Let us assume further that the manufacturer is producing for inventory, so that she has a free choice whether to assemble X, or Y, or both. Because of their similarity, the two instruments have the same labor costs and overhead expenses. In deciding what to produce for a given day, the manufacturer need only consider her inventory of components. The following schedule shows how many components of each type are available and their unit costs:

	# in stock	**Cost per unit**
Component a	180	$0.10
Component b	720	$0.05
Component c	400	$0.50
Component d	210	$0.80

Based upon the foregoing information, what is the production schedule for the day which will earn the maximal gross profit for the manufacturer

Custom Molder

Suppose that custom molder has one injection-molding machine and two different dies to fit the machine. Due to differences in the number of cavities and cycle times, with the first die she can produce 100 cases of six-ounce juice glasses in six hours, while with the second die she can produce 100 cases of ten-ounce fancy cocktail galsses in five hours. She prefers to operate only on a schedule of 60 hours of production per week. She stores the week's production in her own stockroom where she has an effective capacity of 15,000 cubic feet. A case of six-ounce glasses requires 10 cubic feet of storage space, while a case of ten-ounce cocktail glasses requires 20 cubic feet of storage space due to special packaging. The contribution of the six-ounce juice glassses is $5.00 per case; however, the only customer available will not accept more than 800 case per week. The contributionof the ten-ounce cocktail glasses is $4.50 per case and there is no limit on the number that can be sold. How many cases of each type of glass should be produced each week in order to maximize the total contribution?

Charging A Blast Furnace

An iron foundry has a firm order to produce 1000 pounds of casting containing at least 0.45% manganese and between 3.25% and 5.50 % silicon. As these particular casatings are a special order there are no suitable castings on hand. The castings sell for $0.45 per pound. The foundry has 3 types of pig iron available in essentially unlimited quantities, with the following properties:

Iron Type	**Pig A**	**Pig B**	**Pig C**
Silicon	4.0%	1.0%	0.6%
Manganese	0.45%	0.50%	0.40%

Further, the production process is such that pure manganese can also be obtained and added directly to the melt. The costs of the various inputs are:

Inputs	Cost
Pig Iron A	$21 per 1000 lbs.
Pig Iron B	$25 per 1000 lbs.
Pig Iron C	$15 per 1000 lbs.
Manganese	$8 per lb.

It cost 0.50 cents to melt down a pound of pig iron. Out of what inputs should the foundry produce the castings in order to maximize profits.