C&O 350
Assignment 1

Due: Thurs. Jan. 19 (§1), Fri. Jan. 20 (§2,3)

(The details should be worked out by hand. They can be verified on the computer.)

1. In the following two modelling problems, you do *not* need to solve the models.

   (a) A small firm specializes in making five types of spare automobile parts. Each part is first cast from iron in the casting shop and then sent to the finishing shop where holes are drilled, surfaces are turned, and edges are ground. The required worker-hours (per 100 units) for each of the parts of the two shops are shown below:

Part	1	2	3	4	5
Casting	2	1	3	3	1
Finishing	3	2	2	1	1

   The profits from the parts are \$30, \$20, \$40, \$25, and \$10 (per 100 units), respectively. The capacities of the casting and finishing shops over the next month are 700 and 1000 worker-hours, respectively. Formulate the problem of determining the quanitities of each spare part to be made during the month so as to maximize profit.

   (b) There are three types of machines that can be used to make a chemical. The chemical can be manufactured at four different purity levels.

Machine Type	Capacity: Production per Day	Production Costs per Day If Used to Manufacture Purity			
		1	2	3	4
1	50 tons	$900	1000	1250	1500
2	40 tons	600	750	1000	1050
3	25 tons	600	700	800	900
Monthly demand for chemical at purity level (tons)		150	300	90	175
Penalty per ton short		40	60	75	90

The chemical is used by the company internally; if the company does not manufacture enough of it, it can be bought at a price, which is called the penalty for shortage. Assume that there are 30 production days per month at the company. Formulate the problem of minimizing the overall cost as an LP.

2. Chvatal, Problem 2.1 b. page 26.

3. Solve Chvatal, Problem 2.1 c. page 26 geometrically (do not use the simplex method). In addition,
(i) draw the feasible set in $\Re^2$;
(ii) find all the extreme points of the feasible set and, for each of these extreme points, write down the corresponding dictionary.

4. Chvatal, Problem 2.2 page 26.