Simplex Method Problems

Math 20: Introduction to Linear Algebra and Multivariable Calculus
Due October 27, 2004

Consider a company that manufactures plastic lawn ornaments. Their product line consists of gnomes, deer, and flamingoes. The ornaments are produced by three machines—an extruder, an injection molder, and an assembler. The amount of minutes required by each product on each machine is given in the table below, as is the profit on each.

Product	Extruder time	Molder time	Assembler time	Profit
Gnome	2min	1min	2min	$2
Deer	1	0	1	$4
Flamingo	0	3min	2min	$3

In each hour, there are 43 minutes of available time on the extruder, 37 minutes available on the molder, and 42 minutes available on the assembler (the rest of the time the machines are being maintained).

1. Set up the linear programming problem that maximizes profit subject to these constraints.

2. Solve this problem using the geometric method. One way to do this is the following (maybe you can find another):
   (a) The six equations of constraint (this includes the nonnegativity constraints) correspond to planes in $\mathbf{R}^3$, and the vertices of the feasible set are a subset of all three-fold intersections of them. So, find the 17 points which are intersections of any three of the planes.
   (b) Rule out all vertices that don't satisfy all of the constraints. This leaves six vertices of the feasibility set.
   (c) Evaluate the objective function at each of the six vertices and find the maximum.

3. Solve this problem using the simplex method.