Practice Linear Programming problems to set up (DO NOT TRY TO SOLVE yet)

For each problem below,

  a) Name appropriate variables for the above problem. (For example, you might write "x_1 = number of rednecks; x_2 = gallons of beer; x_3 = hundreds of shotgun shells".) Be sure to include appropriate units, if any.
  b) Write down the objective function for the above problem, and whether it should be minimized or maximized.
  c) Write down constraints for the above problem. You don't have to write the non-negativity constraints ($x_1 \geq 0$, $x_2 \geq 0$, etc.)

1. A department store chain has up to $20,000 to spend on television advertising for a sale. All ads will be placed with one television station, where an advertisement costs $1,000 on daytime TV and is viewed by 14,000 potential customers, $2,000 on Prime-time TV and is viewed by 24,000 potential customers, and $1,500 on late-night TV and is viewed by 18,000 potential customers. The television station will not accept a total of more than 15 ads in all three time periods. How many ads should be placed in each time period to maximize the number of potential customers who will see the ads?

2. William & Theodore's Excellent Lawn Seeding Company makes a mixture which contains three types of seeds: bluegrass, rye, and bermuda. The costs per pound of the three types of seed are 20¢, 15¢, and 5¢ respectively. To fill current orders, the company must make at least 5000 pounds of the mixture. In the mixture, the amount of bermuda must be no more than the amount of rye. Finally, because bluegrass is so popular, there must be at least 1000 pounds of it used. How much of each kind of seed should be used to minimize cost?

3. Cerveza Gordo (Motto: "Who drinks beer to get thin anyhow?") makes three kinds of beer: regular, dark, and HEAVY. A national restaurant chain buys 1200 barrels of regular beer, 1000 barrels of dark beer, and 400 barrels of HEAVY beer. It costs $350 to produce a barrel of regular beer, $360 to produce a barrel of dark beer, and $500 to produce a barrel of HEAVY beer. Because it's harder to brew a good HEAVY beer, production of HEAVY beer is never more than half production of regular beer. Finally, total production of all kinds of beer needs to be at least 3000 barrels to satisfy both the restaurant and other customers. How much of each type of beer should be brewed to satisfy all constraints while minimizing cost?

4. A cat breeder has the following amounts of cat food: 90 units of tuna (what IS a unit of tuna, anyhow?), 80 units of liver, and 50 units of chicken. To raise a Siamese cat, the breeder must use 2 units of tuna, 1 of liver, and 1 of chicken per day. Raising a Persian cat takes 1 unit of tuna, 2 of liver, and 1 of chicken each day. If a Siamese cat sells for $12 while a Persian cat sells for $10, how many of each should be raised in order to obtain maximum gross income? What is the maximum gross income?