CSCI 570 - HW 9

Due Friday Nov. 09 (by 23:59)

1. The Canine Products company has two dogfood products, Frisky Pup and Husky Hounds, that are made from a blend of two raw materials, cereal and meat. 1 pound of cereal and 1.5 pounds of meat are needed to make a package of Frisky Pup and it sells for $7 a package. 2 pounds of cereal and 1 pound of meat are needed to make a package of Husky Hound and it sells for $6 a package. Raw cereal costs $1 per pound and raw meat costs $2 per pound. It also costs $1.40 to package the Frisky Pup and $.60 to package the Husky Hound. A total of 240,000 pounds of cereal and 180,000 pounds of meat are available per month. The only production bottleneck is that the factory can only package 110,000 bags of Frisky Pup per month. Management would like to maximize profit. Formulate the problem as a linear program.
2. 720 students have pre-enrolled for the "Analysis of Algorithms" class in Fall. Each student must attend one of the 16 discussion sections, and each discussion section *k* has capacity for *Dk* students. The happiness level of a student assigned to a discussion section *k* is proportional to *k*(*Dk* - *Sk*), where *k* is a parameter reflecting how well the air-conditioning system works for the room used for section *k* (the higher the better), and *Sk* is the actual number of students assigned to that section. We want to find out how many students to assign to each section in order to maximize total student happiness. Express the problem as a linear programming problem.
3. Prove by reduction from 3-SAT that an integer linear program is NP-Complete.

4. Consider the following linear program:

max(3x1 + 2 x2 + x3)

x1 - x2 + x3 ≤ 4

2x1 + x2 + 3x3 ≤ 6

-x1 + 2x3 = 3

x1 + x2 + x3 ≤ 8

x1, x2 ,x3 ≥ 0

Write the dual problem.