Extra Study Questions
Linear Programming

The following questions are to help you gauge your understanding of linear programming. It is not required that you submit the solutions for grading. You may discuss these questions in your Homework Groups or post to the Week 7 Discussion Board.

Remember that there are three possible outcomes when considering a linear programming solution.

1. Optimal solution(s): A finite set of values that satisfy the constraints, so one or more must be optimal.
2. Unbounded solution(s): Infinite values that satisfy the constraints.
3. No solution: No values satisfy the constraints.

Question 1: Consider the following problem

$$\max(x_1 + x_2)$$
$$s.t. |x_1 - x_2| \leq 10$$

Can I solve this problem with a linear program? If so, how?

Question 2: Consider the following problem

$$\min(\max\{x_1, x_2, x_3\})$$
$$s.t. \quad 3x_1 + 2x_2 - 5x_3 \leq 8$$

Can I find a solution for this problem with a linear program? If so, how?

Question 3: Exercise 7.2 in Algorithms by DPV

7.2. Duckwheat is produced in Kansas and Mexico and consumed in New York and California. Kansas produces 15 shnupells of duckwheat and Mexico 8. Meanwhile, New York consumes 10 shnupells and California 13. The transportation costs per shnupell are \$4 from Mexico to New York, \$1 from Mexico to California, \$2 from Kansas to New York, and \$3 and from Kansas to California. Write a linear program that decides the amounts of duckwheat (in shnupells and fractions of a shnupell) to be transported from each producer to each consumer, so as to minimize the overall transportation cost.

Question 4: Exercise 7.3 in Algorithms by DPV

7.3. A cargo plane can carry a maximum weight of 100 tons and a maximum volume of 60 cubic meters. There are three materials to be transported, and the cargo company may choose to carry any amount of each, upto the maximum available limits given below.

- Material 1 has density 2 tons/cubic meter, maximum available amount 40 cubic meters, and revenue $1,000 per cubic meter.
- Material 2 has density 1 ton/cubic meter, maximum available amount 30 cubic meters, and revenue $1,200 per cubic meter.
- Material 3 has density 3 tons/cubic meter, maximum available amount 20 cubic meters, and revenue $12,000 per cubic meter.

Write a linear program that optimizes revenue within the constraints.