

1. Consider the following problem:

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

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

2. Consider the following problem:

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

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

3. Exercise 7.2 in *Algorithms*.

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.

4. Exercise 7.29 part (a) in *Algorithms*.

Hollywood. A film producer is seeking actors and investors for his new movie. There are n available actors; actor i charges s_i dollars. For funding, there are m available investors. Investor j will provide p_j dollars, but only on the condition that certain actors $L_j \subseteq \{1, 2, \dots, n\}$ are included in the cast (all of these actors L_j must be chosen in order to receive funding from investor j).

The producer's profit is the sum of the payments from investors minus the payments to actors. The goal is to maximize this profit.

Question: Express this problem as an integer linear program in which the variables take on values $\{0, 1\}$.