CS325 Practice problem set 5

This problem set covers linear programming and reduction.

1. Consider the problem PDV 7.1, please reduce the linear problem to a different form of linear program in which all variables must non-negative, the constraints are all equations, and the objective is to be minimized.

2. Consider the following problem:

$$\max x_1 + x_2 \text{ s.t. } |x_1 - x_2| \leq 10$$

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

3. Consider the following problem:

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

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

4. PDV 7.5

5. Please formulate the unbounded knapsack problem into a linear program.

6. Consider the following two problems.
   In the **hitting set** problem, we are given a family of sets $\{S_1, S_2, ..., S_n\}$ and a budget b, and we wish to find if there exists a set H of size $\leq b$ that intersects every S_i.

   In the **vertex cover** problem, we are given a graph $G = (V, E)$ and a budget b, and we wish to find if there exists a vertex cover S of size $\leq b$ such that S touches every edge in E.

   Show that the vertex cover problem can be reduced to the hitting set problem.