4-1：线性规划 [课后]

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请独立完成作业，不得抄袭。
若参考了其它资料，请给出引用。
鼓励讨论，但需独立书写解题过程。

第一部分　作业

☑ Problem 1 (TC 29.2-3)

In the single-source shortest-paths problem, we want to find the shortest-path weights from a source vertex s to all vertices $v \in V$. Given a graph G, write a linear program for which the solution has the property that d_v is the shortest-path weight from s to v for each vertex $v \in V$.

✎ Solution

☑ Problem 2 (TC 29.4-3)

Write down the dual of the maximum-flow linear program, as given in lines (29.47) – (29.50) on page 860. Explain how to interpret this formulation as a minimum-cut problem.

✎ Solution

☑ Problem 3 (TC 29-1: *Linear-inequality feasibility*)

Given a set of m linear inequalities on n variables $x_1, x_2, \ldots, x_n$, ***the linearinequality feasibility problem*** asks whether there is a setting of the variables that simultaneously satisfies each of the inequalities.

a. Show that if we have an algorithm for linear programming, we can use it to solve a linear-inequality feasibility problem. The number of variables and constraints that you use in the linear-programming problem should be polynomial in n and m.

b. Show that if we have an algorithm for the linear-inequality feasibility problem, we can use it to solve a linear-programming problem. The number of variables and linear inequalities that you use in the linear-inequality feasibility problem should be polynomial in n and m, the number of variables and constraints in the linear program.

Solution