1. (1pt) Consider the following linear programming problem

max	$z=x_1+x_2$
subject to	$x_1+2x_2 \leqslant 4$
	$x_1 \geqslant x_2 - 1$
	$4x_1+2x_2 \leqslant 12$
	$x_1, x_2 \geqslant 0$

1) Convert the problem to the standard form (i.e., maximize $c^T x$ such that $Ax \leq b$, $x \geqslant 0$)
2) Derive its dual problem.

2. (2pt) For each of the following problems, match the type of convex problem (LP, GP, QP, SDP) :

(a) min $1/\sqrt{xy}$ s.t. $x^2 + y^2 < 7$

(b) max $\min(x_1, x_2)$ s.t. $x_1+x_2<5$

(c) min $\Sigma_{i,j} X_{ij}$ s.t. $v^T X v \geqslant 0$ (i,j denote the indices of X)

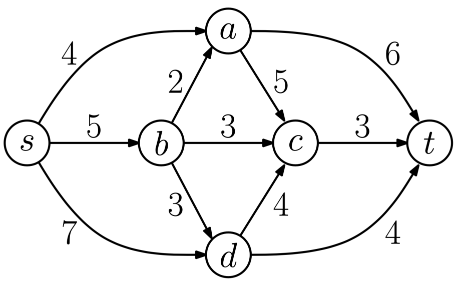
(d) min $\|Ax - b\|_2^2$

3. (1pt) Consider the following problem

$\min\limits_{\boldsymbol{x} \in \mathbb{R}^2}$	$f(\boldsymbol{x}) = \frac{1}{2}(x_1^2 + x_2^2)$
subject to	$2x_1 - x_2 = 5$

Find the Lagrange dual function and the dual problem.

4. (1pt) Consider the following flow network where the number on each edge denotes the capacity.



1) What is the maximum flow that the flow network can reach?
2) What is the minimum cut of the network? Show the minimum cut by partitioning the network into two subsets of vertices.