620-361 Operations Research Techniques and Algorithms

Practice Class 8

1. Write down the Wolfe dual of:

\[
\begin{align*}
\min_{x \in \mathbb{R}^n} & \quad x_1 - x_2 + x_2^2 \\
\text{s.t.} & \quad x \geq 0 \\
& \quad \frac{x_1^2}{4} + x_2^2 \leq 1
\end{align*}
\]

Reduce the number of variables of the dual problem. [Hint: Eliminate the vector of multipliers corresponding to \(x \geq 0\).]

2. Write down the Wolfe dual of:

\[
\begin{align*}
\min & \quad f(x) \\
\text{s.t.} & \quad x \geq 0 \\
& \quad Ax = b
\end{align*}
\]

where \(f\) is smooth and \(A \in \mathbb{R}^{m \times n}\), \(b \in \mathbb{R}^m\). Simplify the dual problem by eliminating the vector of multipliers corresponding to \(x \geq 0\), to obtain a nonlinear dual problem with linear constraints.