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Integer Programming  
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\[
\begin{align*}
\text{max} & \quad x_1 + 2x_2 \\
\text{st} & \\
x_1 + x_2 & \leq 250 \\
7x_1 + 3x_2 & \geq 450 \\
25x_1 - 12x_2 & \geq 2750 \\
x_2 & \leq 125 \\
x_1, x_2 & \geq 0 \\
x_1, x_2 & \in \mathbb{Z}^2
\end{align*}
\]

(a) Graph the feasible region.

(b) Find the optimal LP solution. Find the optimal IP solution.

(c) State the Dantzig cut.

(d) Are there any other valid inequalities? If yes, state how you would go about finding one.

Solution:
(a) See Figure 1.
(b) \(z_{IP}^* = 344.5946, \ x_{IP}^* = (155.4054, 94.5946)\)
\(z_{IP}^* = 344, \ x_{IP}^* = (156, 94)\)
Figure 1: Feasible Region

(c) $x_3 + x_4 \geq 1$

(d) Yes. If the information from the optimal Simplex tableau is known, a Gomory cut can be constructed.