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Recitation

Problem Set 3
Homework 3 due Sep 27, 2016 at
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PART A

Consider two non-negative integral variables x_1 and x_2. Suppose that $x_1 \leq 60$ and $x_2 \leq 50$. Model the following constraint using an additional binary variable w:

$x_1 < 30$ or $x_2 \geq 20$.

Note that the first inequality is strict. Select the correct way of modeling this "OR" constraint using linear and integer constraints. Select the (one) correct answer.

○ $x_1 \leq 29 - M(1 - w)$
   $x_2 \geq 20 + Mw$

◉ $x_1 \leq 29 + M(1 - w)$ ✔
   $x_2 \geq 20 - Mw$

○ $x_1 \leq 30 - M(1 - w)$
   $x_2 \geq 20 + Mw$

○ $x_1 \leq 30 + M(1-w)$
$x_2 \geq 20 - Mw$

EXPLANATION

Solution

$x_1 \leq 29 + M(1-w)$
$x_2 \geq 20 - Mw$

It is often difficult to work with strict inequalities when modeling MIPs (Mixed Integer/Linear Programs). In this case, x_1 is known to be integer valued. We transformed "$x_1 < 30$" into "$x_1 \leq 29$."

PART B

How small can M be in the correct answer for PART A?

| 31 |

✔ **Answer:** 31

31

EXPLANATION

Solution

31

In order to make the constraint $x_1 \leq 29 + M(1-w)$ redundant when $w = 0$, one needs M to be at least 31. In order to make the constraint $x_2 \geq 20 - Mw$ be redundant when $w = 1$, we need M to be at least 20.

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