Extra Credit

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Extra Credit Challenge

Construct linear constraints that model the given situation (where all variables are binary)

① 1

$x = 1$ or $y = 1$

This is an *OR* operation, so our constraints are:

Linear constraint:
$x + y \geq 1$

② 2

$x = 1$ xor $y = 1$

Linear constraint:
$x + y = 1$

③ 3

Exactly 5 of $\{x_1, x_2 \ldots x_n\}$ are 1.

Linear constraint:
$x_1 + x_2 + \ldots x_n = 5$

④ 4

If $x = 1$ then $y = 1$

Linear constraint:

$x = y$

? 5

If $x = 1$, then $y = 0$

Linear constraint:

$x + y = 1$

? 6

If $x_1 = 1$ and $x_2 = 1$ then $x_3 = 0$

Linear constraint:

$(x_1 + x_2) + x_3 \leq 2$

? 7

If $x_1 = 1$ and $x_2 = 0$ then $x_3 = 0$

Linear constraint:

$x_1 - x_2 + x_3 \leq 1$

? 8

$x = y_1 \vee y_2$

Linear constraint:

$y_1 + y_2 \geq x$

? 9

$$x = y_1 \wedge y_2$$

Linear constraint:

$$y_1 + y_2 \geq 2x$$

Table of Operations for Reference

For x, y binary variables,

Operation	
AND	$x + y = 2$
OR	$x + y \geq 1$
NAND	$x + y \leq 1$
NOR	$x + y = 0$
XOR	$x + y = 1$

Constructed By Observing the Sums of Binary Variables in a K-map