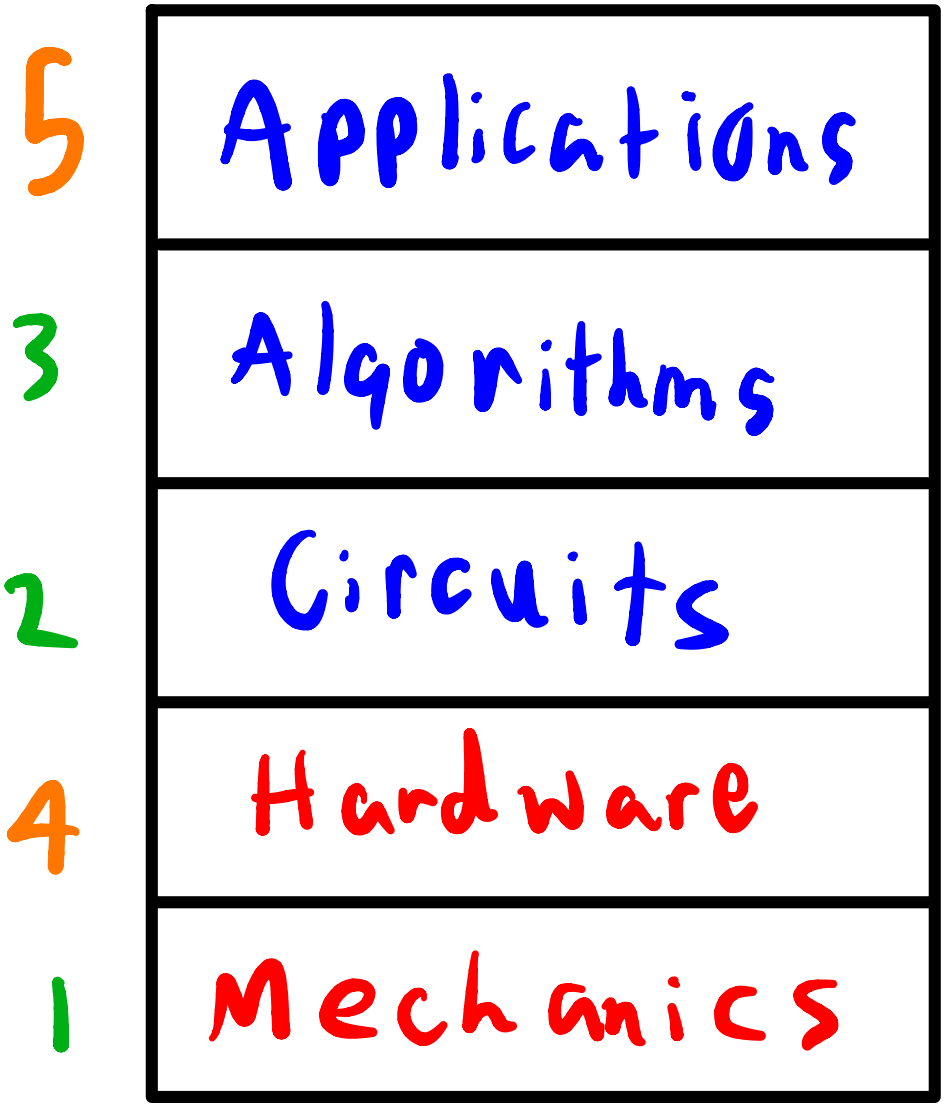
Quantum Circuits III

The Quantum Computing Stack



Now Getting our hands dirty w/ circuits

Last Time

2^+ Qubits

A Quantum Computer

Can do anything a

Classical Computer

can do

States and Gates

Covered

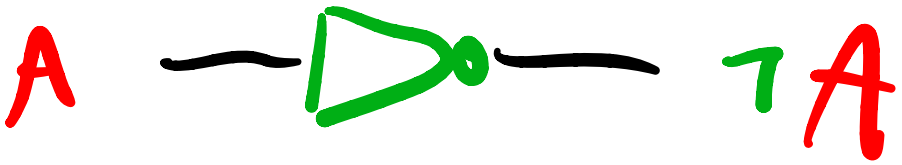
$$|0\rangle = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \qquad X = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

$$|1\rangle = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \qquad Y = \begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}$$

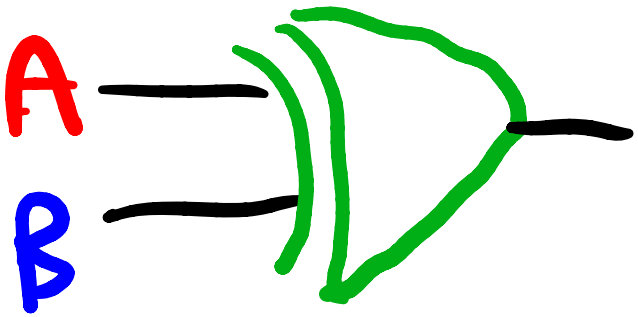
$$|+\rangle = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ 1 \end{bmatrix} \qquad Z = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$$

$$|-\rangle = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ -1 \end{bmatrix} \qquad H = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

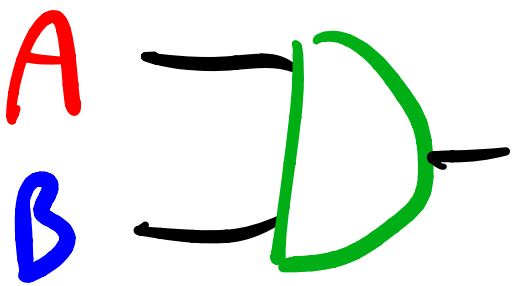
Classical Gates



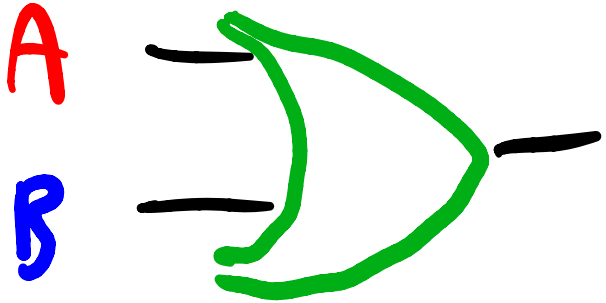
NOT



XOR



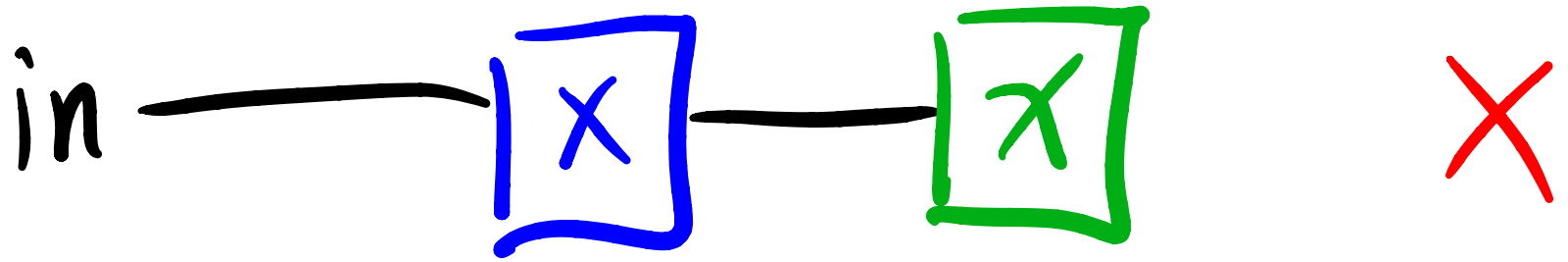
AND



OR

NOT

in	out
0	1
1	0



Want to seperate in and out

XOR

in_1	in_0	out
0	0	0
0	1	1
1	0	1
1	1	0

AND

in_1	in_0	out
0	0	0
0	1	0
1	0	0
1	1	1

OR

in_1	in_0	out
0	0	0
0	1	1
1	0	1
1	1	1

Half-Adder

Binary

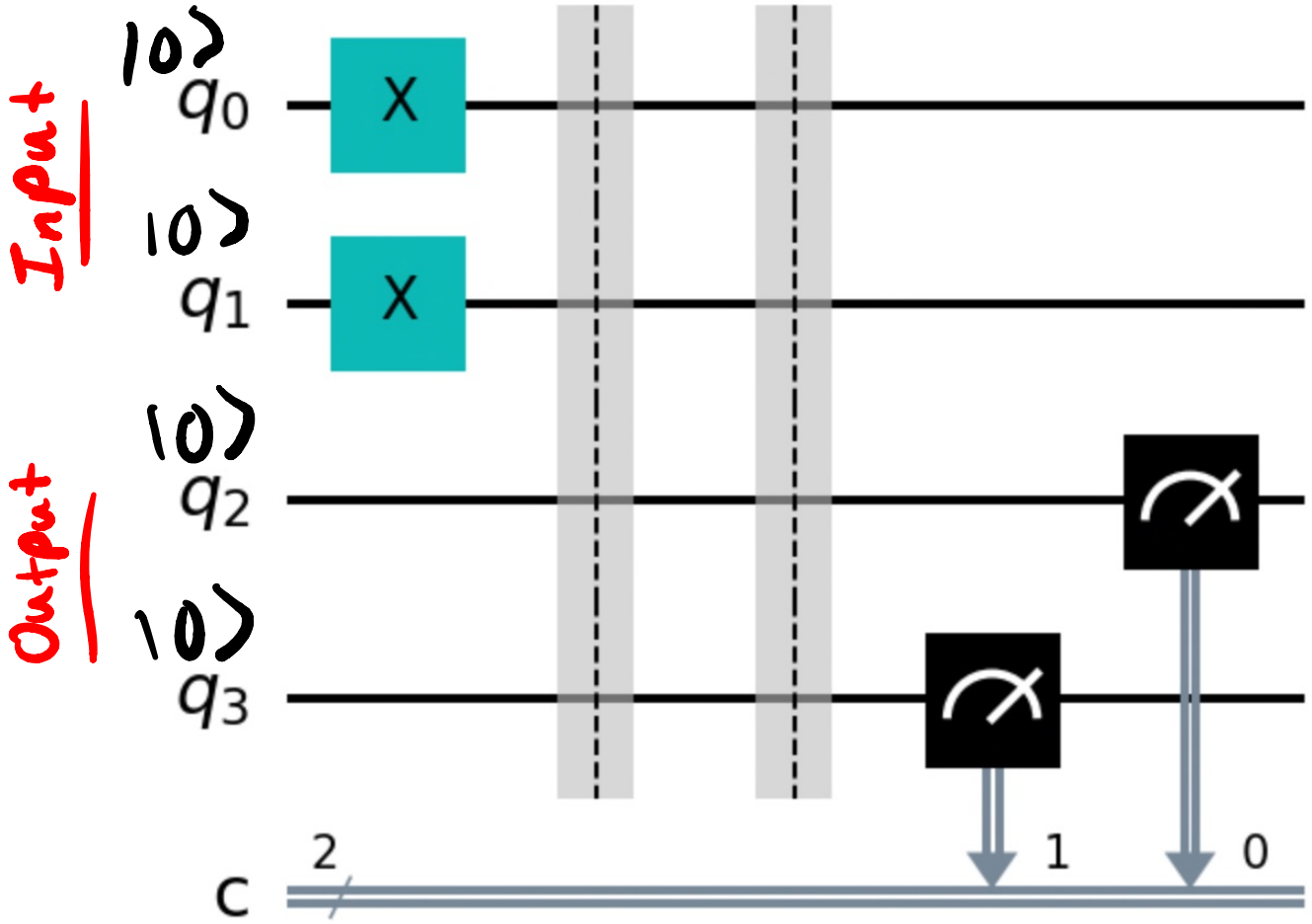
in_1	in_0	out_1	out_0
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

$in_1 + in_0 = out_1\ out_0$

Half-Adder Skeleton

States Gates Measurement

Why are th 'X' Gates in the states portion?



Keyword: Dragon

Full - Adder

in_2	+ in_1	+ in_0	= out_1	out_0
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1