Classical logical gates (selection)

NOT	
In	Out
0	1
1	0

AND	
In	Out
00	0
01	0
10	0
11	1

$NAND$	
In	Out
00	1
01	1
10	1
11	0

OR	
In	Out
00	0
01	1
10	1
11	1

NOR	
In	Out
00	1
01	0
10	0
11	0

XOR	
In	Out
00	0
01	1
10	1
11	0

Classical logical gates (selection, cont.)

Fredkin	
In	Out
000	000
001	001
010	010
011	101
100	100
101	011
110	110
111	111

Toffoli	
In	Out
000	000
001	001
010	010
011	011
100	100
101	101
110	111
111	110

1-Qubit gates (selection)

Pauli matrix (x):

$$X \equiv \hat{\sigma}_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$

In	Out
$\vert 0 \rangle$	$\vert 1 \rangle$
$\vert 1 \rangle$	$\vert 0 \rangle$

Pauli matrix (y):

$$Y \equiv \hat{\sigma}_y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$$

In	Out
$\vert 0 \rangle$	$i \vert 1 \rangle$
$\vert 1 \rangle$	$-i \vert 0 \rangle$

Pauli matrix (z):

$$Z \equiv \hat{\sigma}_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

In	Out
$\vert 0 \rangle$	$\vert 0 \rangle$
$\vert 1 \rangle$	$-\vert 1 \rangle$

Hadamard:

$$H = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$$

In	Out
$\vert 0 \rangle$	$\frac{1}{\sqrt{2}} (\vert 0 \rangle + \vert 1 \rangle)$
$\vert 1 \rangle$	$\frac{1}{\sqrt{2}} (\vert 0 \rangle - \vert 1 \rangle)$

Phase:

$$S = \begin{pmatrix} 1 & 0 \\ 0 & i \end{pmatrix}$$

In	Out
$\vert 0 \rangle$	$\vert 0 \rangle$
$\vert 1 \rangle$	$i \vert 1 \rangle$

1-Qubit gates (selection, cont.)

"$\pi/8$" gate:

$$T = \begin{pmatrix} 1 & 0 \\ 0 & e^{i\frac{\pi}{4}} \end{pmatrix}$$

$$= e^{i\frac{\pi}{8}} \begin{pmatrix} e^{-i\frac{\pi}{8}} & 0 \\ 0 & e^{i\frac{\pi}{8}} \end{pmatrix}$$

In	Out
$\|0\rangle$	$\|0\rangle$
$\|1\rangle$	$e^{i\frac{\pi}{4}}\|1\rangle$

2-Qubit gate CNOT

CNOT:

$$U_{CN} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix}$$

In	Out
$\|00\rangle$	$\|00\rangle$
$\|01\rangle$	$\|01\rangle$
$\|10\rangle$	$\|11\rangle$
$\|11\rangle$	$\|10\rangle$