CNOT: creating entangled states

Figure 10: The CNOT, or controlled-NOT, gate.

The matrix description of the gate with control qubit 2 and target qubit 1 is as follows:

$$\mathrm{CNOT}_{21} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix}.$$

initially a = |0>+|1>, b = |0>

```
q   a b   p -> a b⊕a
0   0 0  0.5   0 0  0.5
1   0 1        0 1
2   1 0  0.5   1 0
3   1 1        1 1  0.5
```

Using an array:

```
q[0], q[1], q[2], q[3]

swap q[2] and q[3]
```

```
class TwoQubit:
  def cnot(self):
      '''Controlled NOT operation'''
      self.onezero, self.oneone = self.oneone, self.onezero
      return self
```

Using names for the complex amplitudes:

```
zerozero, zeroone, onezero, oneone
```

[Python Quantum Computing simulator](), Juliana Peña, 2011.