



$$\text{minimize } Z_0 Z_1 + Z_0 Z_2$$

$$\hat{H} = Z_0 Z_1 + Z_0 Z_2$$

→ Two  $|\psi\rangle$  minimize this problem,  $|011\rangle$  and  $|100\rangle$

## QUBO

$$\text{Minimize } q(x_0, \dots, x_m) \quad x_i \in \{0, 1\}$$

Example: Subset Sum  $S = \{1, 4, -2\}$   $T = 2$

→ Minimum number of numbers in  $S$  to add up to  $T$   
 $x_m$  is 1 if the value in  $S$  is included

3.5  $S = \{1, -2, 3, -4\}$   $T = 0$

$$\text{Minimize } q(x_0, \dots, x_3) = (a_0 x_0 + \dots - T)^2$$

$$= (x_0 - 2x_1 + 3x_2 - 4x_3 - 0)^2$$

$$= x_0^2 - 4x_0x_1 + 6x_0x_2 + 4x_0^2 - 12x_1x_2 + 9x_2^2 + 16x_3^2 - 8x_3x_0 + 16x_3x_1 - 24x_3x_2$$

$$x_i^2 = x_i \quad x_j = (1 - z_j) / 2$$

→ This would get you to the Ising model

3.3

$$\langle 100 | Z_0 Z_1 + Z_0 Z_2 | 100 \rangle$$

$$= -1 \cdot 1 + -1 \cdot 1$$

$$= -2$$