Assignment #7. Hugo SALOU

We consider a two-qubit error and a one qubit-error

$$E_0 := (Z\otimes \mathbb{1}\otimes \mathbb{1})\otimes(\mathbb{1}\otimes \mathbb{1}\otimes \mathbb{1})\otimes(Z\otimes \mathbb{1}\otimes \mathbb{1}),$$
$$E_1 := (\mathbb{1}\otimes \mathbb{1}\otimes \mathbb{1})\otimes(Z\otimes \mathbb{1}\otimes \mathbb{1})\otimes(\mathbb{1}\otimes \mathbb{1}\otimes \mathbb{1}).$$

Then,

$$E_0|\bar{0}\rangle = \frac{1}{2\sqrt{2}}(|000\rangle - |111\rangle)\otimes(|000\rangle + |111\rangle)\otimes(|000\rangle - |111\rangle)$$
$$\parallel$$
$$E_1|\bar{1}\rangle = \frac{1}{2\sqrt{2}}(|000\rangle - |111\rangle)\otimes(|000\rangle + |111\rangle)\otimes(|000\rangle - |111\rangle)$$

As Shor's code would be able to correct the one-qubit error E_1 back into $|\bar{1}\rangle$, it would also (falsely) "correct" the two-qubits error E_0 into $|\bar{1}\rangle$ since $E_0|\bar{0}\rangle = E_1|\bar{1}\rangle$.

We can conclude that Shor's code is not resistant to two-qubits errors.

END of Assigment #7.