

# ET4340 Electronics for Quantum Computing

## Homework 2

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**Problem 1: The Bell basis** In class, we introduced the *Bell states*

$$\begin{aligned}|\Psi_+\rangle &= \frac{1}{\sqrt{2}}(|01\rangle + |10\rangle) \\ |\Psi_-\rangle &= \frac{1}{\sqrt{2}}(|01\rangle - |10\rangle) \\ |\Phi_+\rangle &= \frac{1}{\sqrt{2}}(|00\rangle + |11\rangle) \\ |\Phi_-\rangle &= \frac{1}{\sqrt{2}}(|00\rangle - |11\rangle)\end{aligned}$$

Like the computational basis  $|00\rangle, |01\rangle, |10\rangle, |11\rangle$ , this set of states forms a basis for the four-dimensional Hilbert space of two qubits. Show that this basis is ortho-normal. That is:

1. Show that the inner product of every Bell state with itself is unity. Thus, show that  $\langle\Psi_+|\Psi_+\rangle = I$ .