1 Exercise Sheet

1.1 Getting Fluent with Quantum Circuits.

Designing small circuits by hand is the quickest way to **build intuition**. The dexterity you gain here building simple quantum circuits, will pay off later when you design your own quantum neural network layers.

Task. Draw *minimal* circuits that implement each transformation:

a) $|00\rangle \longrightarrow |10\rangle$

b) $|00\rangle \longrightarrow \dfrac{|00\rangle - |11\rangle}{\sqrt{2}}$ (Negative-phase Bell state)

c) $|000\rangle \longrightarrow \dfrac{|000\rangle + |111\rangle}{\sqrt{2}}$ (GHZ state)

d) $|000\rangle \longrightarrow \dfrac{|001\rangle + |010\rangle}{\sqrt{2}}$

Solutions. One of many possible answers:

a)

b)

c)

d)