Introduction to Quantum Programming and Semantics 2025
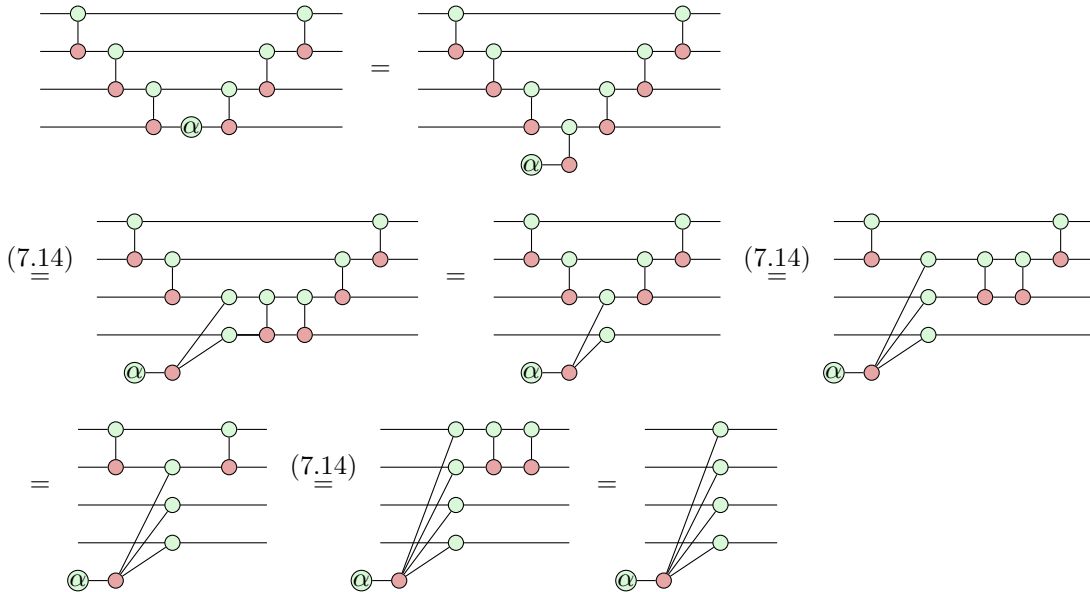## Tutorial week 9

Exercise 1

There are many possible solutions. Here are two options:

Exercise 2

Exercise 3

In general,

$$CCZ \, |abc\rangle = \sqrt{2} \Big(\sum_{x,y,z=0}^{1} (-1)^{xyz} \, \langle xyz|abc\rangle \Big) |abc\rangle$$

The only term that survives is where $x = a$, $y = b$, and $z = c$. But $(-1)^{xyz} = 1$ unless $x = y = z = 1$, in which case it is -1.

Exercise 4