Making an Or Gate

- **Description**. Let us recall our simplified city map.

A	B
C	D

We saw in the last activity that city district A has access to an EV station if we put an EV station in distract A or B or C. If you are familiar with computer science, this is like an OR gate: a special gate that tells us if at least one variable is set to **true**. To turn our EV problem into a program, we will need to know how to do an OR gate, so that we can tell the program that A or B or C should be true. In particular, we will want to do a certain Z-rotation whenever this occurs. It may not be obvious, but it turns out that the following circuit will do this for us!
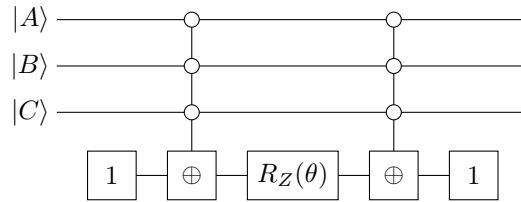
Note that the second gate is just to clean things up (otherwise, we would not know the state of the fourth qubit, and eventually we would have to measure it...). Your goal is to check that this OR gate actually works. This means that if at least one of the first three wires are in state $|1\rangle$, then we should do the rotation. Using the ZX-calculus, see what happens in these cases: $|000\rangle$, $|100\rangle$, and $|110\rangle$. Below are the expected answers.
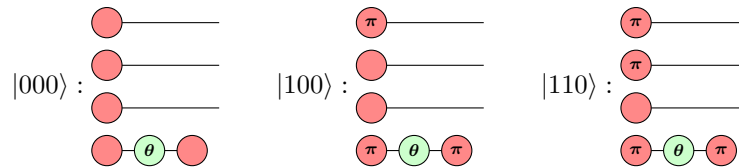
- **Submission**. Three equations of ZX-diagrams.