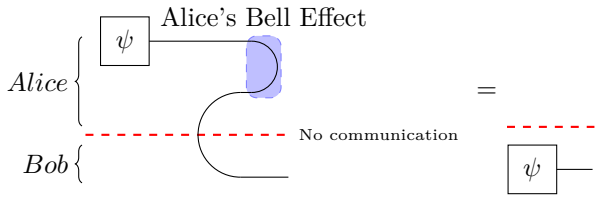
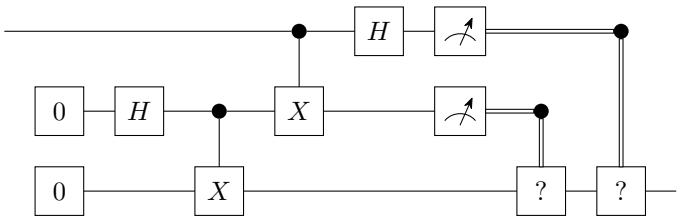
The Bell Effect

- **Description.** Remember from the fourth lesson that quantum teleportation is achieved by first preparing a Bell state, and then performing a Bell effect on the correct pair of qubits.



However, we still have not learned how to perform a Bell effect. Intuitively, performing a Bell effect should just be the reverse of preparing a Bell pair. This means that we should apply a controlled-NOT gate, followed by a Hadamard gate, and then check that the first two qubits are back in state $|00\rangle$. Of course, we cannot check the state of first two qubits without measuring them, and in the process, they might end up in some other state such as $|01\rangle$, $|10\rangle$, or $|11\rangle$. If we end up with the wrong state, then we will have to fix things up in order to actually achieve quantum teleportation. To fix things up, Alice can send her measurements to Bob, who can then apply some gates to his qubit, as in the following circuit.



The boxes labeled by question marks are the operations Bob has to perform to fix things up. Your challenge is to convert this circuit into a ZX-diagram, and then figure out what the two operations should be by simplifying it to the teleportation diagram shown above.

- **Submission.** An equation of ZX-diagrams.