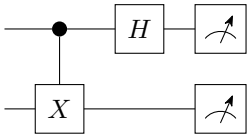
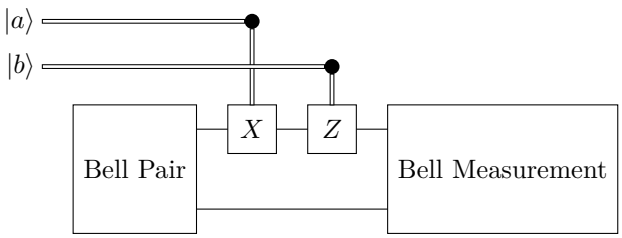
Two-for-One Coding

- **Description.** In the first challenge, you figured out how to prepare a Bell state. Then, in the second challenge you learned how to apply a Bell measurement to achieve a Bell state. In case you haven't completed the second challenge yet, the Bell measurement circuit is given below.



In this activity, you will implement the superdense coding protocol. Recall that the first step is to prepare a Bell pair and the final step is to perform a Bell measurement. What remains is for Bob to encode his two-qubit message. To do this, Bob will first check if the first qubit is in state $|1\rangle$, then Bob will apply a NOT gate to his qubit. Otherwise, Bob will do nothing. Likewise, if the second qubit is in state $|1\rangle$, then Bob will apply a Z gate to his qubit. Otherwise, Bob will do nothing. In this challenge, you will implement the entire circuit. The values of the bits should appear as controls in your circuit. Schematically, your circuit should look as follows.



- **Submission.** A screenshot of the circuit and the Quirk file.