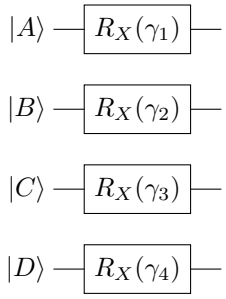
Mixing It Up

- **Description**. If you have already completed **Making an OR Gate**, then you would have seen that we can write our EV placement rules as a quantum program. This gives us a way to check our solutions to the placement problem with four blocks.

A	**B**
C	**D**

  However, this is no good if we start with a bad solution like $|000\rangle$. For this reason, we also have what is called a *mixer*. On a conventional computer, we could do this by randomly switching the bits on or off using NOT gates. However, this would not be very interesting, since nothing quantum is going on. The clever idea is that a NOT gate is just a special X-rotation! Since we have four qubits, the mixer will look like the following circuit, where γ_1, γ_2, γ_3, and γ_4 are like our probabilities.



  Let's pretend that we apply this to the state $|0000\rangle$. Figure out what would happen in the following cases.

  - The angles are $\gamma_1 = 0$ and $\gamma_2 = \pi$ and $\gamma_3 = 0$ and $\gamma_4 = \pi$.
  - The angles are $\gamma_1 = 0$ and $\gamma_2 = \pi/2$ and $\gamma_3 = -\pi$ and $\gamma_4 = \pi/2$.

  Can you see how this relates to randomly flipping the bits?

- **Submission**. The final state in both cases, with an explanation given for how you found your answer. Compare this to flipping the bits on or off at random.