Welcome to Homework 22!

Please answer the following questions based on content from Lecture and Lab this week.

1. Which of the following represent Qubit relaxation times and Qubit decoherence times:
    a. relaxation time: V1, decoherence time: V2
    b. relaxation time: T2, decoherence time: T1
    c. relaxation time: B4, decoherence time: B5
    d. relaxation time: T1, decoherence time: T2

2. Randomized benchmarking is used to test which quality:
    a. Average Gate Fidelty
    b. Quantum Algorithm Accuracy
    c. Qubit Decoherence Time

3. *True or false*: All the qubits that can be constructed today use the same underlying technology.

    a. True
    b. False

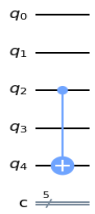
4. *True or false*: An Engineer tests a quantum computer and finds out that the average gate fidelity is 90%. This means that any circuit will run with a 90% accuracy on this quantum computer.

    a. *True*
    b. *False*

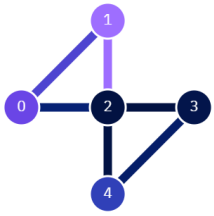
5a. On quantum computers, the length of the path between physical qubits is proportional to the fidelity of a gate that connects them.

Given this 5-qubit circuit and these 3 different computers on which to run the circuit, which layout provides the most direct path (i.e. between qubit 2 and qubit 4), and therefore lowest error, for this circuit.

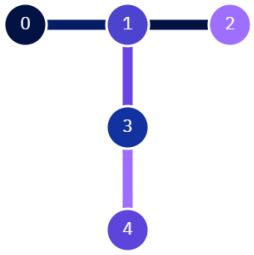
For this problem you can assume that all three of the computers have the same average CNOT error values across each qubit to qubit link for each computer. That means that each link has the same error value across each computer.



a. Yorktown:



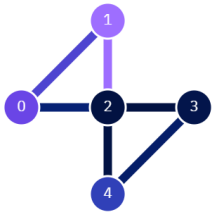
b. Belem:



c. Bogota:

5b. **Challenge Problem:** Using only Yorktown and Belem, try using the noise models to simulate the circuit on each of these computers (as we did in lab). Which computer has a better error?

a. Yorktown:



b. Belem: