# Phys 31415 Homework #3

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Please do all the work on your own. Be curious and honest and prosperity shall be yours. If you have any questions seriously email me. Check out this before trying the homework.

## 1 CNOT what you think

For this assingment we will get some practice using the CNOT gate.

1. In the exercises of Chapter 5, the first question discusses a circuit of three CNOT gates used together on two qubits with random states.

   (a) Create two random states for each qubit and create and run this circuit. Print out the state of the circuit before the three CNOTS and after, what does this circuit do? Why or how? Explain. (I have an example of initializing a random state here. It's on the house.)

   (b) What happens if we add another CNOT gate while following the pattern of alternating control and target qubits?

   (c) After these first two results is CNOT unitary? Explain briefly.

   (d) Make a new circuit with two new random states (keep track of them) , apply CNOT and print out resulting state vector. Now in another cell, use the same random states but now apply two CNOTS one after another while keeping the control and target quibts the same for both. Is CNOT unitary? Explain briefly.

2. Create your own circuit using what we learned so far. Any gates you would like, use 2-3 qubits. This is a care free question where I am asking you to get your hands dirty and play around with Qiskit now that you know a few things. Your very own circuit should include...

   (a) Print the state vector before and after the circuit.

   (b) Measure the circuit and print out a histogram of the results.

   (c) Draw the circuit using the draw function.

   (d) A brief explanation of what your circuit does and how it compares to what you may have expected.