

# Phys 31415 Homework #2

Abdulah Amer

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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 Know Your Gates

You Should have met a few Quantum Gates by now. Namely, X,Y,Z and H. I encourage you to do some calculations by hand first then write code to check your work. It can help in this assignment to answer some of the questions especially 'what happened'. Also reuse code, there is alot of similar and repeating code, I am trying to get you to practice so much that using gates and taking measurements is easy to do! There is no substitute for practice.

1. Create a quantum circuit with one qubit and one classical bit. Use the Hadamard gate once on the first qubit. For the following parts use this circuit as a starting point.
  - (a) After the starting point circuit apply the X gate to the first qubit. In one cell take a measurement and plot a histogram of the results. In another cell, remake an unmeasured circuit and print out the resulting state vector. Explain in words what happened. Does the histogram help tell us what happened?
  - (b) After the starting point circuit apply the Y gate to the first qubit. In one cell take a measurement and plot a histogram of the results. In another cell, remake an unmeasured circuit and print out the resulting state vector. Explain in words what happened. Does the histogram help tell us what happened?
  - (c) After the starting point circuit apply the Z gate to the first qubit. In one cell take a measurement and plot a histogram of the results. In another cell, remake an unmeasured circuit and print out the resulting state vector. Explain in words what happened. Does the histogram help tell us what happened?
2. For each of the above parts ( a, b, and c) add on a Hadamard gate to the end of each for 3 new circuits. You should have  $HXH$ ,  $HYH$ , and  $HZH$ . For each take a measurement and plot a histogram of the results. Also print out resulting state vectors. Explain in words what happened. Does the histogram tell us what happened?