

## Lab 4 – Designing Tests

The second component of Lab 4 is designing effective tests. In this part, please submit either a .py file with tests and comments or a write up describing a) the types of tests you would do and b) justification for why these tests are necessary.

In both cases, there is no length requirement. The expectation is that you will put a good faith effort into making reasonable tests and **evaluating your code critically**.

As an example, I have included a brief description of the tests that your qubit.py code was run with. **Note that, for your write up, you should be more descriptive than I have been!** Tests are not just for you to validate your code work – it's for others to understand your code's behavior + ensure that changes they make still keep the code valid.

## QUBIT.PY TESTING HARNESS AND RUBRIC

- I. Set and get state
  - A. Can initialize qubit with classical bits (setvalue)
  - B. Can initialize qubit with superpositions of classical states (setvalue)
  - C. Can initialize qubit with superpositions of quantum states, i.e. imaginary (setvalue)
  - D. Can print qubit state in text (getvalue\_braket)
    - 1. + points if the text is pretty
  - E. Can return qubit state in vector form (getvalue\_vector)
- II. Apply (unitary) gates
  - A. Not swaps the probabilities (gate\_not)
  - B. H is an appropriate matrix multiply (gate\_H)
  - C. Z is an appropriate phase change (gate\_Z)
  - D. Test identities (ZZ, HH, HZH=X)
- III. Apply measurements
  - A. Measure is projective, i.e. it only ever yields  $|0\rangle$ ,  $|1\rangle$  (measure)
  - B. Measure is probabilistic, i.e.  $|+\rangle$  goes to  $|0\rangle$ ,  $|1\rangle$  with probabilities (measure)
  - C. Measure has accurate probabilities, i.e.  $|+\rangle$  goes to  $|0\rangle$ ,  $|1\rangle$  with accurate probabilities
- IV. Identities
  - A.  $XX = I$
  - B.  $ZZ = I$
  - C.  $HH = I$
  - D.  $HZH = X$