Assignment 3

Problem 1:

Let the following be Pauli gates

,

represented in the eigenbasis of .

We know matrix is unitary iff , (dagger) where . Note this as Identity matrix.

We know matrix is Hermitian iff , which is a conjugate transpose of a matrix

then . Therefore Hermitian.

. Therefore, unitary.

Can we repeat for the remaining gates

Problem 2:

We first talk about bra-ket ( bra & ket) with inner and outer products.

Remember, . Then the bra notation is

We can express each of the Pauli operator in outer product notation

Let’s check

Let’s check

Can you work through and get the rest of the Pauli operators?

Problem 3:

Express the Pauli X operator through outer products of the states and and show

that = and = .

Can you show the other? How about with Pauli Y and Pauli Z?

Problem 4:

We recall from the discussion that the tensor product of two matrices and with

entries and is given by the Kronecker product

Calculate , and , where is the identity matrix and is the

Pauli operator given above.

Let us start with what we know from above

We can then show that

Can you finish the rest? How about Pauli Y and Pauli Z?