CommLab2

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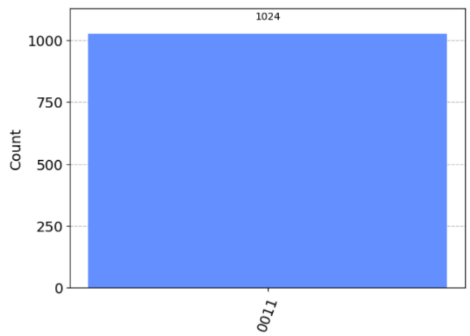
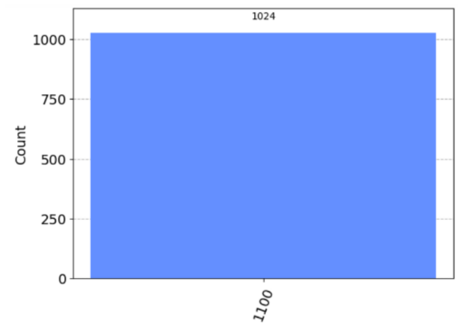
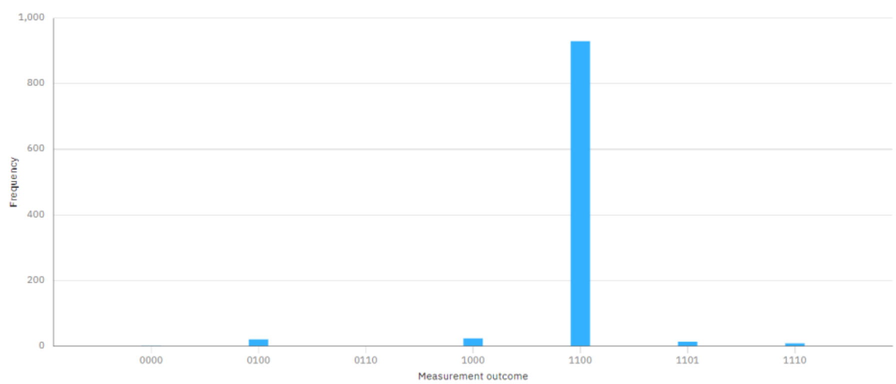
1. (a) seed: 100, generated bit string: 0011 / seed: 60, generated bit string: 1100





As shown in graph, the SER and BER are 0 when using a simulator.

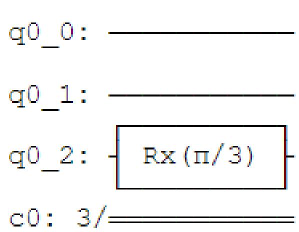
(b) seed: 60, generated bit string: 1100

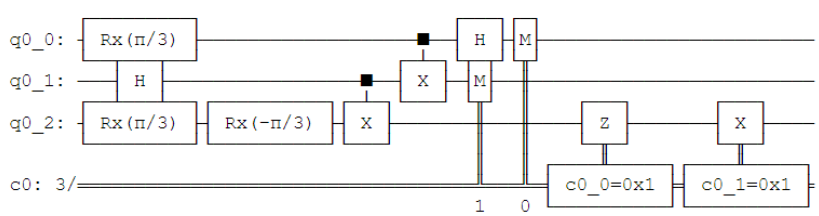


SER = 1-(929/1000) = 7.1%, BER = 74/4000 = 1.85%

BER is lower than SER because there are only several bits that are wrong in a wrong package.

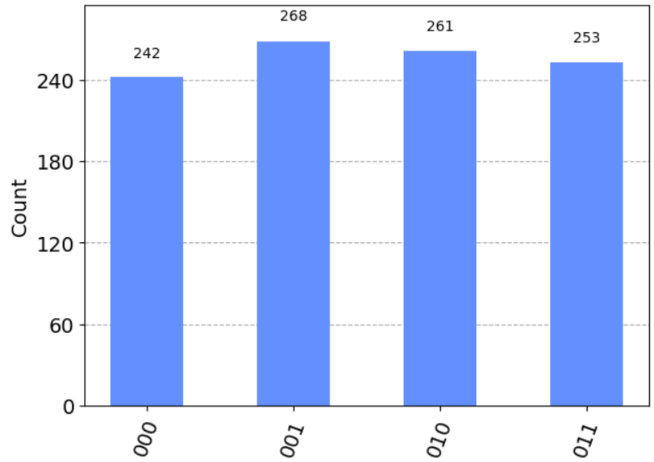
2. (a) (i) inner product = 0.9999999999999999+3.061616997868382e-17j ≈ 1





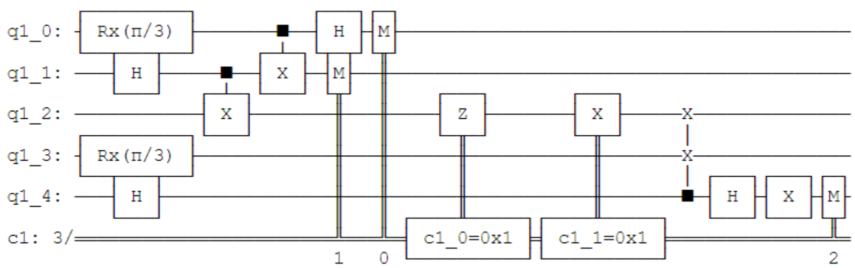
^ desired state ^ teleportation

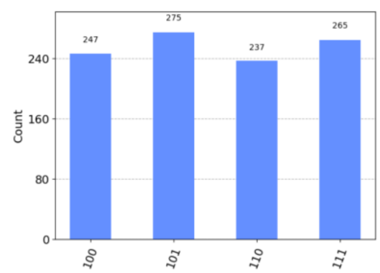
(ii) After applying rx(-pi/3) to q[2]:



Here we can see that q[2] is always 0, which means it is the zero state.

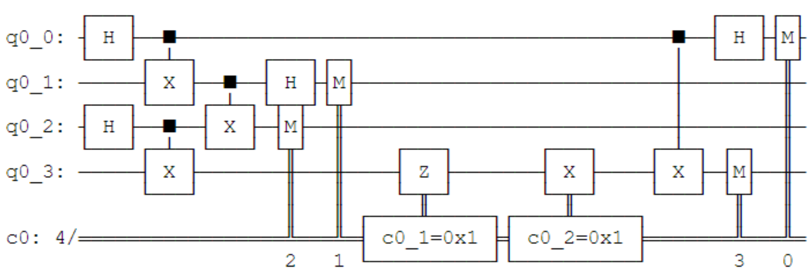
(iii) Swap test

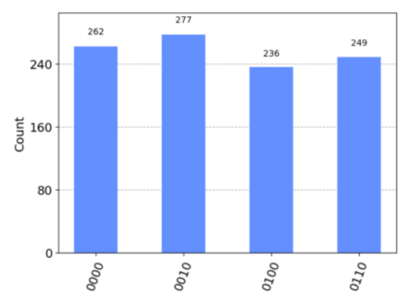




c[2] is always 0, thus q[4] is the zero state, and the swap test is passed.

(b)





The results show that q0q3 is indeed the bell state since c[0] and c[3] are 0 under all cases.

3. (a) for seed = 0: c = 73/100 = 72% (theoretical value 75%)
   (b) for seed = 0: c = 91/100 = 85% (theoretical value 85%)
   The measurement is performed by applying a Ry(-pi/8) gate and a z gate, since the two states can be prepared from 0 and 1 state by applying gate and Ry(pi/8) gate.