Lab2 Report

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1 Problem1

1.1 (a). Superdense Coding

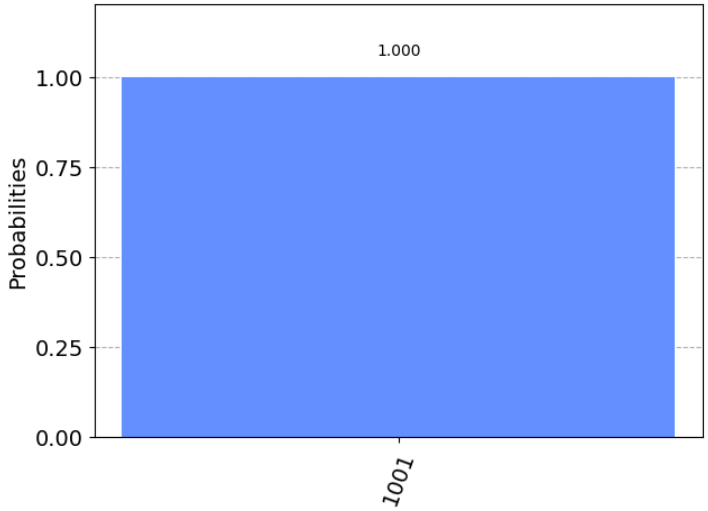

Figure 1: Result on local device

SER = 0 %, BER = 0% The relationship between SER and BER is **SER** = **BER**.

1.2 (b). Superdense Coding on Real Device

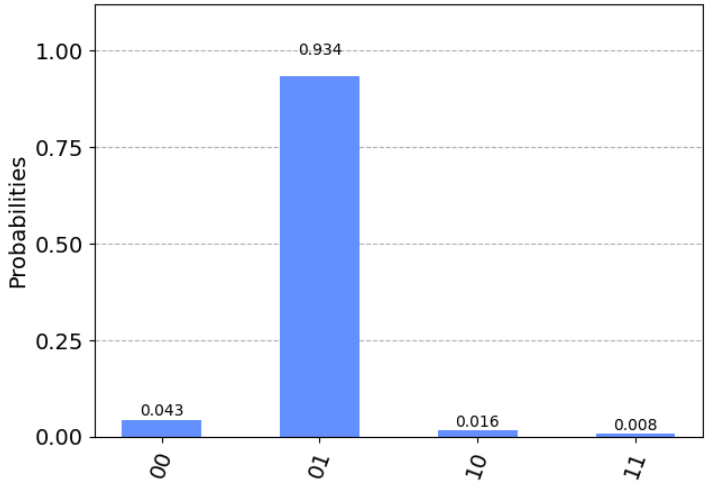

Figure 2: Results on real device

Note: I try to use 4-bit circuit on IBM device, but it shows errors that I can't fix it, so I reduce it to 2-bit.
On real device, SER = 6.6%, BER = 4.15%. The relationship between SER and BER is **SER** > **BER**

2 Problem2

2.1 (a). Verify the state received by Bob is the same as Alice's original state or not

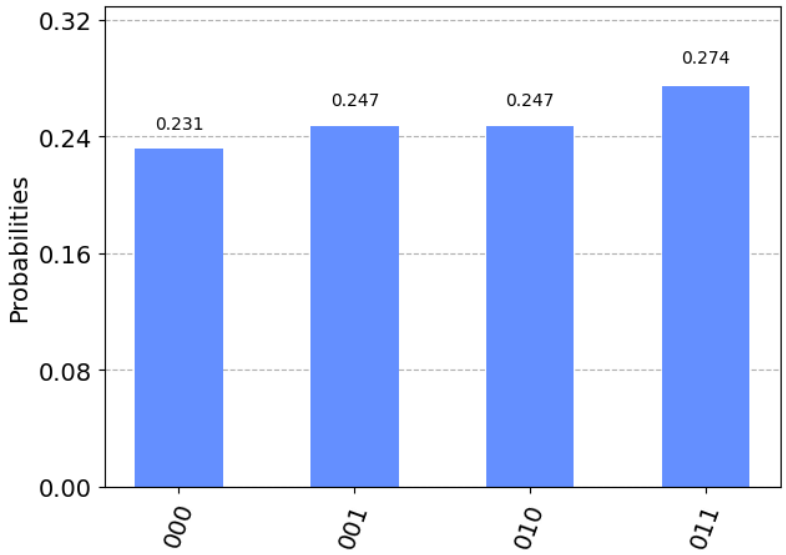

Figure 3: Method (ii): Using inverse operation

In above figure, we can see the q2 is always 0, so it means that the received state is the same with the original one.

2.2 (b). Entanglement Swapping

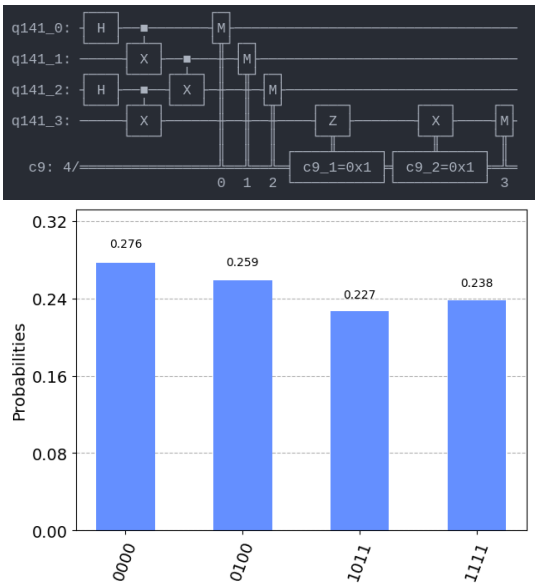

Figure 4: Entanglement Circuit and its measure result

We can see the first bit and the last bit in all the outputs of result are the same.

3 Problem3

3.1 (a). Probability of Eve's guess

Probability is around 40.43 %

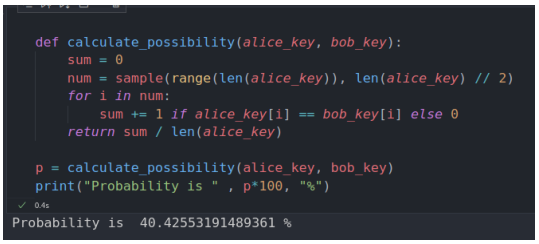

Figure 5: Prob. of Eve's guess is correct

3.2 (b). Probability of Eve's guess when she changed the basis

Probability is around 54 %

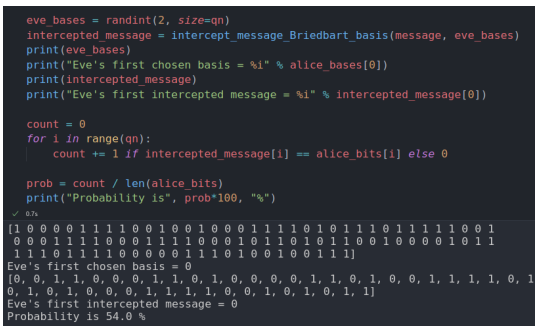

Figure 6: Prob. of Eve's guess is correct when changing basis

A Appendix

Q1: lab2q1.ipynb
Q2: lab2q2.ipynb
Q3: lab2q3.ipynb