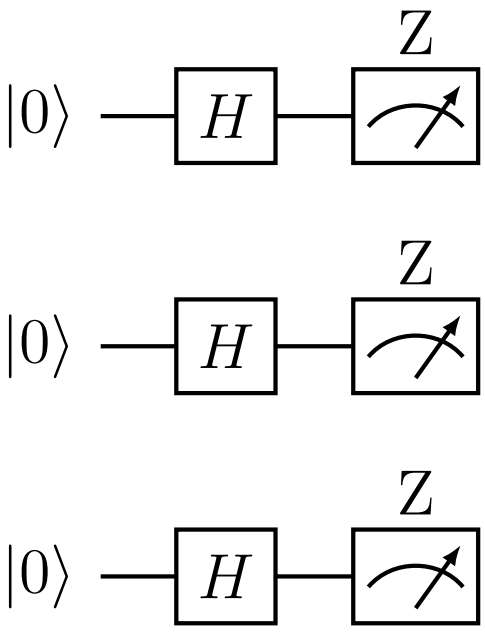
HOMEWORK 15

QUANTUM CIRCUITS

In this homework we would like to become more familiar with constructing quantum circuits as well as get a feeling for what some of the components do. For each set of questions, construct the given circuit using the **IBM Quantum Experience Circuit Composer**. After running the circuit using the **"ibm_qasm_simulator"**, use the resulting **Measurement Probabilities** graph to answer the questions about the effect of circuit on the initial qubits. For additional information about the IBM Quantum Circuit Composer use this reference: **https://quantum-computing.ibm.com/docs/iqx/overview.**

For **Questions 1-4** recreate the following circuit using the IBM circuit composer:



1. Which of the following **closest matches** the probability of measuring the bit string $|000\rangle$?

   a) 100%

   b) 50%

   c) 25%

   d) 12.5%

2. Which of the following **closest matches** the probability of measuring the bit string $|011\rangle$?

   a) 100%

   b) 50%

   c) 25%

   d) 12.5%

3. In how many different can one arrange 3 bits (000,001,010, etc.)?

   a) 4

   b) 8

   c) 16

   d) 32

4. After running the circuit in the simulator, which of the following bit strings is **not** measured at all?

   a) $|101\rangle$

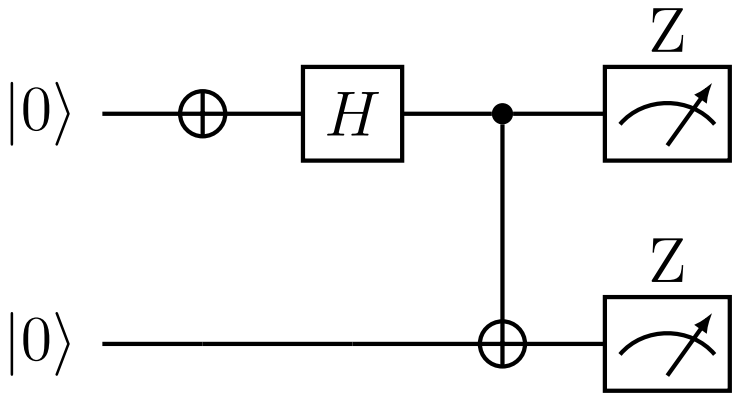
   b) $|001\rangle$

   c) $|110\rangle$

   d) $|111\rangle$

   e) None of the above, all arrangements of 3 bits are possible measurements.

For **Questions 5-8** recreate the following circuit using the IBM circuit composer:



5. Which of the following **closest matches** the probability of measuring the bit string $|11\rangle$?

   a) 100%

   b) 50%

   c) 25%

   d) 0%

6. Which of the following **closest matches** the probability of measuring the bit string $|10\rangle$?

   a) 100%

   b) 50%

   c) 25%

   d) 0%

7. What is the probability that both bits are the same (ie. the probability of measuring $|00\rangle$ OR $|11\rangle$)?

   a) 100%

   b) 50%

   c) 25%

   d) 0%

8. What is the probability that the bits are different (ie. the probability of measuring $|01\rangle$ OR $|10\rangle$)?

   a) 100%

   b) 50%

   c) 25%

   d) 0%