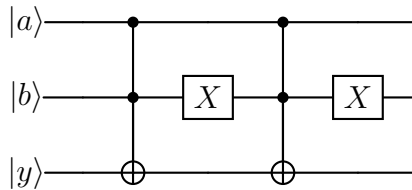


MAT 399**Quiz 4****Fall 2026**

1. Consider the quantum circuit U_f :



What is the final state if $|a\rangle = |b\rangle = |y\rangle = |1\rangle$, so input is $|111\rangle$?

- a) $|110\rangle$ b) $|101\rangle$ c) $|111\rangle$ d) $|010\rangle$ e) $|011\rangle$

Correct Answer: $|110\rangle$

2. Same circuit and function f as in the previous problem. What is the function f , such that U_f computes f on the final state of the third qubit given that $y = 0$ and ab is a bit string of length 2? Determine the signature string s of f in the following way: $s = s_0s_1s_2s_3$ where

$$s_0 = f(00), \quad s_1 = f(01), \quad s_2 = f(10), \quad s_3 = f(11).$$

- a) 0011 b) 1001 c) 0000 d) 1100 e) 1011

Correct Answer: 0011

3. Same circuit and function f as in the previous problem. Find the final state if $|a\rangle = |x_+\rangle$, $|b\rangle = |x_-\rangle$, and $|y\rangle = |0\rangle$. If we measure the final state in the computational basis of $\mathbb{H}_3$ what is the probability that we get value 2 (associated with the basis element 010)?

- a) $\frac{1}{4}$ b) $\frac{1}{2}$ c) $\frac{1}{8}$ d) 1 e) 0

Correct Answer: $\frac{1}{4}$

4. Same circuit and input and final state as in the previous problem. If we measure the final state in the computational basis of $\mathbb{H}_3$ what is the probability that we get value 6 (associated with the basis element 110)?

- a) $\frac{1}{4}$ b) $\frac{1}{2}$ c) $\frac{1}{8}$ d) 1 e) 0

Correct Answer: 0

5. Let A be the gate or matrix so that $A|0\rangle = \frac{1}{2}(|0\rangle - i\sqrt{3}|1\rangle)$ and $A|1\rangle = \frac{1}{2}(|1\rangle - i\sqrt{3}|0\rangle)$. Find an eigenvector of A with eigenvalue $\lambda = e^{i\pi/3}$.

- a) $|x_+\rangle$ b) $|x_-\rangle$ c) $|0\rangle$ d) $|1\rangle$ e) $|0\rangle + i\sqrt{3}|1\rangle$

Correct Answer: $|x_-\rangle$