Lab13 **Alikhan Semembayev**

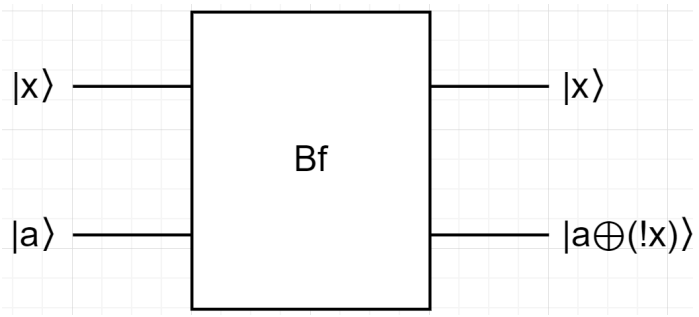
1. Consider the function f3 where f3(0)=1 and f3(1)=0.

a. **What would be an oracle associated with this function?**
b. **Build the internal circuit of the oracle. (There is no single way to do this.)**
c. **What is the matrix associated with this quantum operation? (Textbook mentions it, but it is incorrect!)**

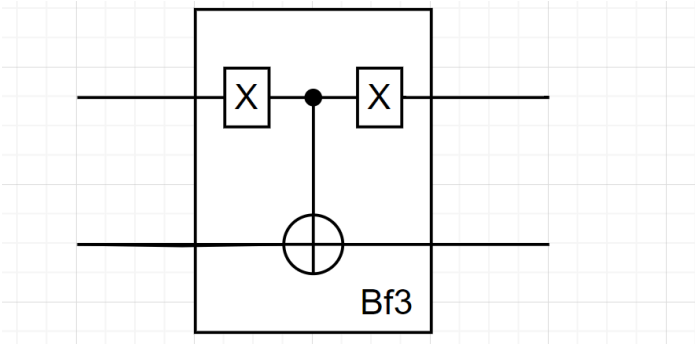
Answer:

f3(0)=1; f3(1)=0; f3(x)=!x
$a \oplus f3(x) = a \oplus (!x)$

a)



b)



c)

ax	00	01	10	11
00	0	0	1	0
01	0	1	0	0
10	1	0	0	0
11	0	0	0	1

3. Let's now consider a function that receives two bits as input and outputs a single bit. It works as follows:

f(00) = f(01) = 1 and f(10) = f(11) = 0.

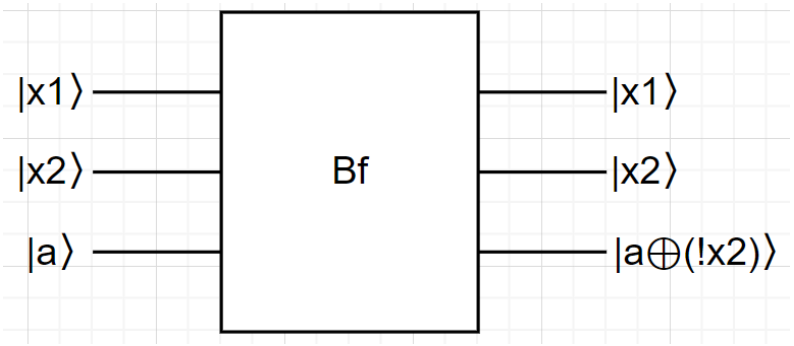
a. **Is this function balanced, constant, or none?**
b. **What would be an oracle associated with this function?**
c. **What is the matrix associated with this quantum operation? Hint: It should be a 8 * 8 matrix.**

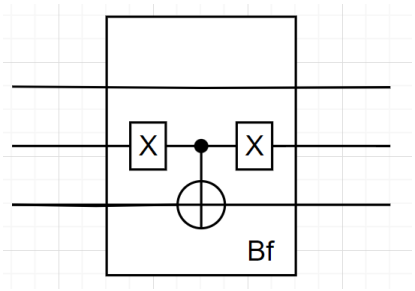
Answer:

f(00) = f(01) = 1 f(10) = f(11) = 0 f(x2,x1) = !x2

a) Balanced.

b)





c)

a x2 x1	000	001	010	011	100	101	110	111
000	0	0	0	0	1	0	0	0
001	0	0	0	0	0	1	0	0
010	0	0	1	0	0	0	0	0
011	0	0	0	1	0	0	0	0
100	1	0	0	0	0	0	0	0
101	0	1	0	0	0		0	0
110	0	0	0	0	0	0	1	0
111	0	0	0	0	0	0	0	1