Intro to Quantum Computing : ECES622 - Winter 2012

80/80

Homework 2

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1.

A AND 0 = 0

A	0	A*0
0	0	0
1	0	0

A + 1 = 1

A	1	A+1
0	1	1
1	1	1

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A + (A AND B) = A

A	B	AB	A+AB
0	0	0	0
0	1	0	0
1	0	0	1
1	1	1	1

A + ((~A) AND B) = A + B

A	A'	B	A'B	A+A'B	A+B
0	1	0	0	0	0
0	1	1	1	1	1
1	0	0	0	1	1
1	0	1	0	1	1

2.

AB	f0	f1	f2	f3	f4	f5	f6	f7	f8	f9	fa	fb	fc	fd	fe	ff
00	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
01	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
10	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
11	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

F9 = (~A)(~B) + AB

A	A'	B	B'	A'B'	AB	A'B'+AB	f9
0	1	0	1	1	0	1	1
0	1	1	0	0	0	0	0
1	0	0	1	0	0	0	0
1	0	1	0	0	1	1	1

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F6 = A(~B) + (~A)B

A	A'	B	B'	AB'	A'B	AB'+A'B	f6
0	1	0	1	0	0	0	0
0	1	1	0	0	1	1	1
1	0	0	1	1	0	1	1
1	0	1	0	0	0	0	0

F2 = A(~B)

A	B	B'	AB'	f2
0	0	1	0	0
0	1	0	0	0
1	0	1	1	1
1	1	0	0	0

3.

a	b	CarryIn	Sum	CarryOut
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

a	b'	CarryIn'	ab'CarryIn'
0	1	1	0
0	1	0	0
0	0	1	0
0	0	0	0
1	1	1	1
1	1	0	0
1	0	1	0
1	0	0	0

a	a’	b	b’	CarryIn	CarryIn'
0	1	0	1	0	1
0	1	0	1	1	0
0	1	1	0	0	1
0	1	1	0	1	0
1	0	0	1	0	1
1	0	0	1	1	0
1	0	1	0	0	1
1	0	1	0	1	0

a	b	CarryIn	abCarryIn
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

a'	b'	CarryIn	a'b'CarryIn
1	1	0	0
1	1	1	1
1	0	0	0
1	0	1	0
0	1	0	0
0	1	1	0
0	0	0	0
0	0	1	0

a'	b	CarryIn	a'bCarryIn
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0

a'	b	CarryIn'	a'bCarryIn'
1	0	1	0
1	0	0	0
1	1	1	1
1	1	0	0
0	0	1	0
0	0	0	0
0	1	1	0
0	1	0	0

a	b	CarryIn'	abCarryIn'
0	0	1	0
0	0	0	0
0	1	1	0
0	1	0	0
1	0	1	0
1	0	0	0
1	1	1	1
1	1	0	0

a	b	CarryIn	abCarryIn
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Sum = a'b'CarryIn + a'bCarryIn' + ab'CarryIn' + abCarryIn

a'b'CarryIn	a'bCarryIn'	ab'CarryIn'	abCarryIn	a'b'CarryIn+a'bCarryIn'+ab'CarryIn'+abCarryIn	Sum
0	0	0	0	0	0
1	0	0	0	1	1
0	1	0	0	1	1
0	0	0	0	0	0
0	0	1	0	1	1
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	1	1	1

CarryOut = a'bCarryIn + ab'CarryIn + abCarryIn' + abCarryIn

a'bCarryIn	ab'CarryIn	abCarryIn'	abCarryIn	a'bCarryIn+ab'CarryIn+abCarryIn'+abCarryIn	CarryOut
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
1	0	0	0	1	1
0	0	0	0	0	0
0	1	0	0	1	1
0	0	1	0	1	1
0	0	0	1	1	1

CarryOut = a'bCarryIn + ab'CarryIn + abCarryIn' + abCarryIn

= a'bCarryIn + ab'CarryIn + abCarryIn' + abCarryIn + abCarryIn + abCarryIn

= (a'bCarryIn + abCarryIn) + (ab'CarryIn + abCarryIn) + (abCarryIn' + abCarryIn)

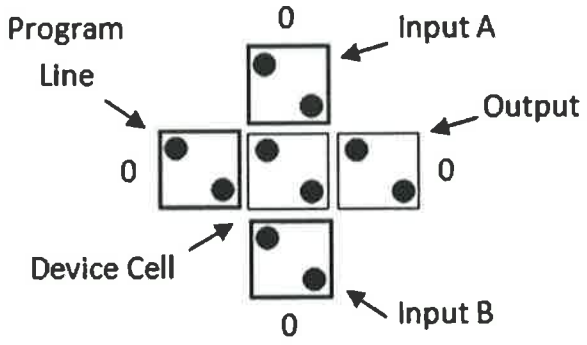
= b(a'CarryIn + aCarryIn) + a(b'CarryIn + bCarryIn) + ab(CarryIn' + CarryIn)

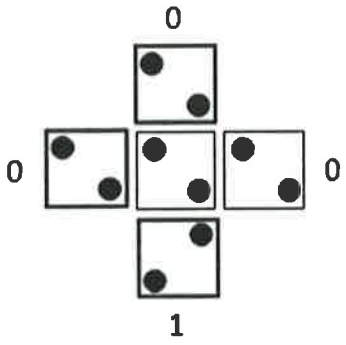
= b(a' + a)CarryIn + a(b' + b)CarryIn + ab(1)

= b(1)CarryIn + a(1)CarryIn + ab

= bCarryIn + aCarryIn + ab

4. Programmable QCA AND Gate





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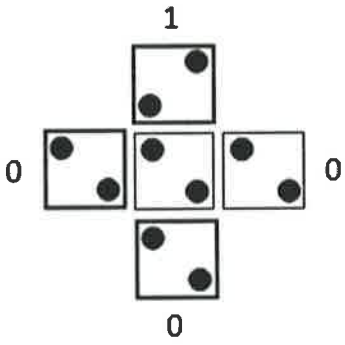

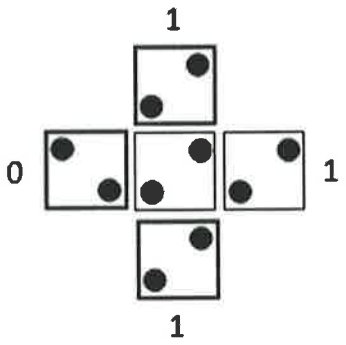

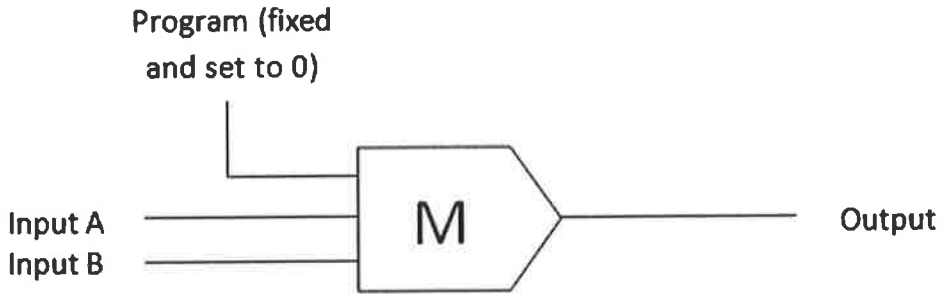

Program	A	B	Out
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1