HW b0010 Write Up

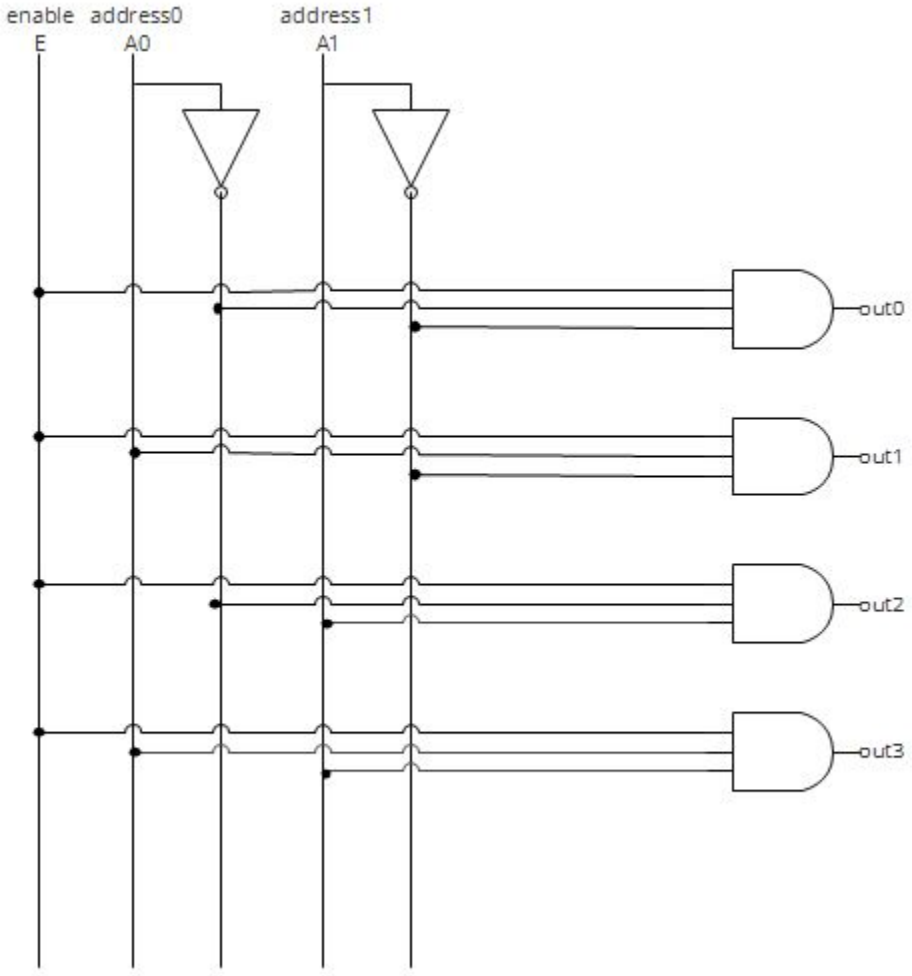
Meg McCauley, September 25, 2015, Computer Architecture

1. Decoder

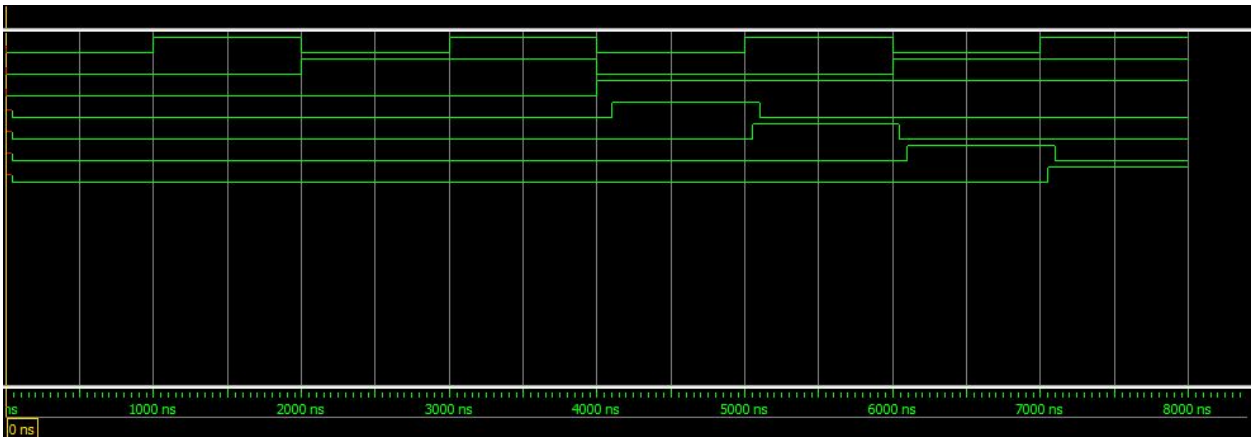
Equation

$$Out_1 = E\bar{A}_0\bar{A}_1 \qquad Out_2 = EA_0\bar{A}_1$$
$$Out_3 = E\bar{A}_0A_1 \qquad Out_4 = EA_0A_1$$

Circuit Diagram



Waveform



Test Bench

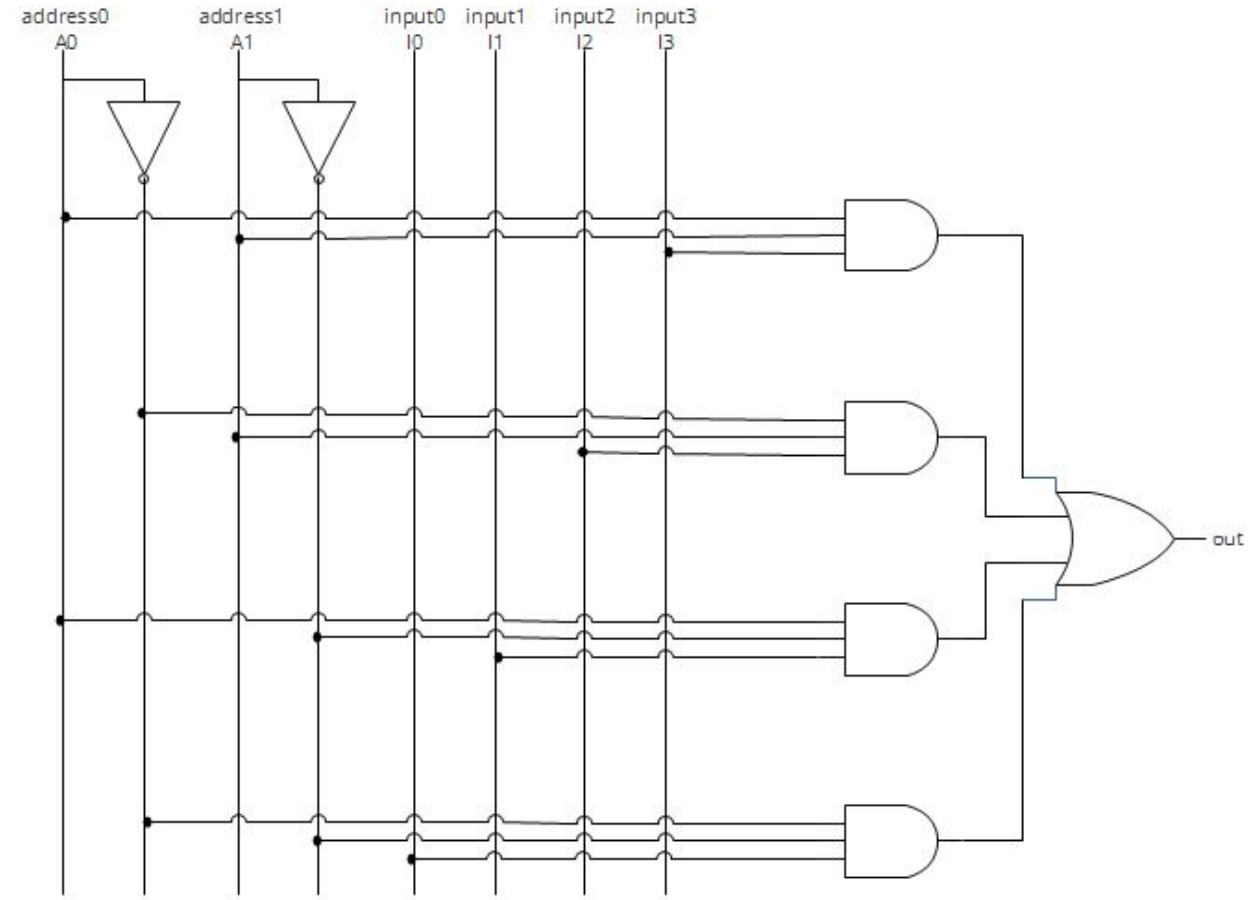
En	A0	A1	O0	O1	O2	O3	Expected Output
0	0	0	0	0	0	0	All false
0	1	0	0	0	0	0	All false
0	0	1	0	0	0	0	All false
0	1	1	0	0	0	0	All false
1	0	0	1	0	0	0	O0 Only
1	1	0	0	1	0	0	O1 Only
1	0	1	0	0	1	0	O2 Only
1	1	1	0	0	0	1	O3 Only

2. Multiplexer

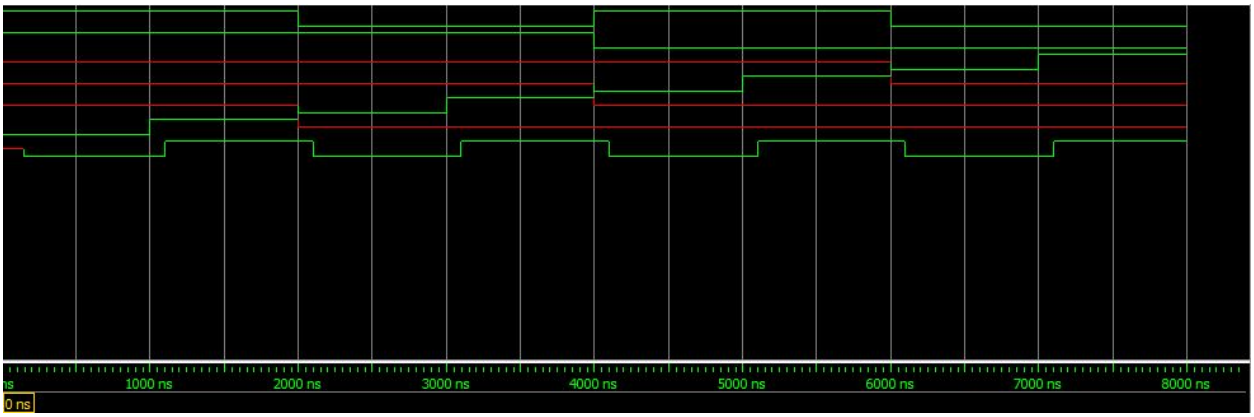
Equation

$$Out = A_0 A_1 I_3 + \bar{A}_0 A_1 I_2 + A_0 \bar{A}_1 I_1 + \bar{A}_0 \bar{A}_1 I_0$$

Circuit Diagram



Waveform



Test Bench

A0	A1	I0	I1	I2	I3	Output	Expected Output
1	1	x	x	x	0	0	0
1	1	x	x	x	1	1	1
0	1	x	x	0	x	0	0
0	1	x	x	1	x	1	1
1	0	x	0	x	x	0	0
1	0	x	1	x	x	1	1
0	0	0	x	x	x	0	0
0	0	1	x	x	x	1	1

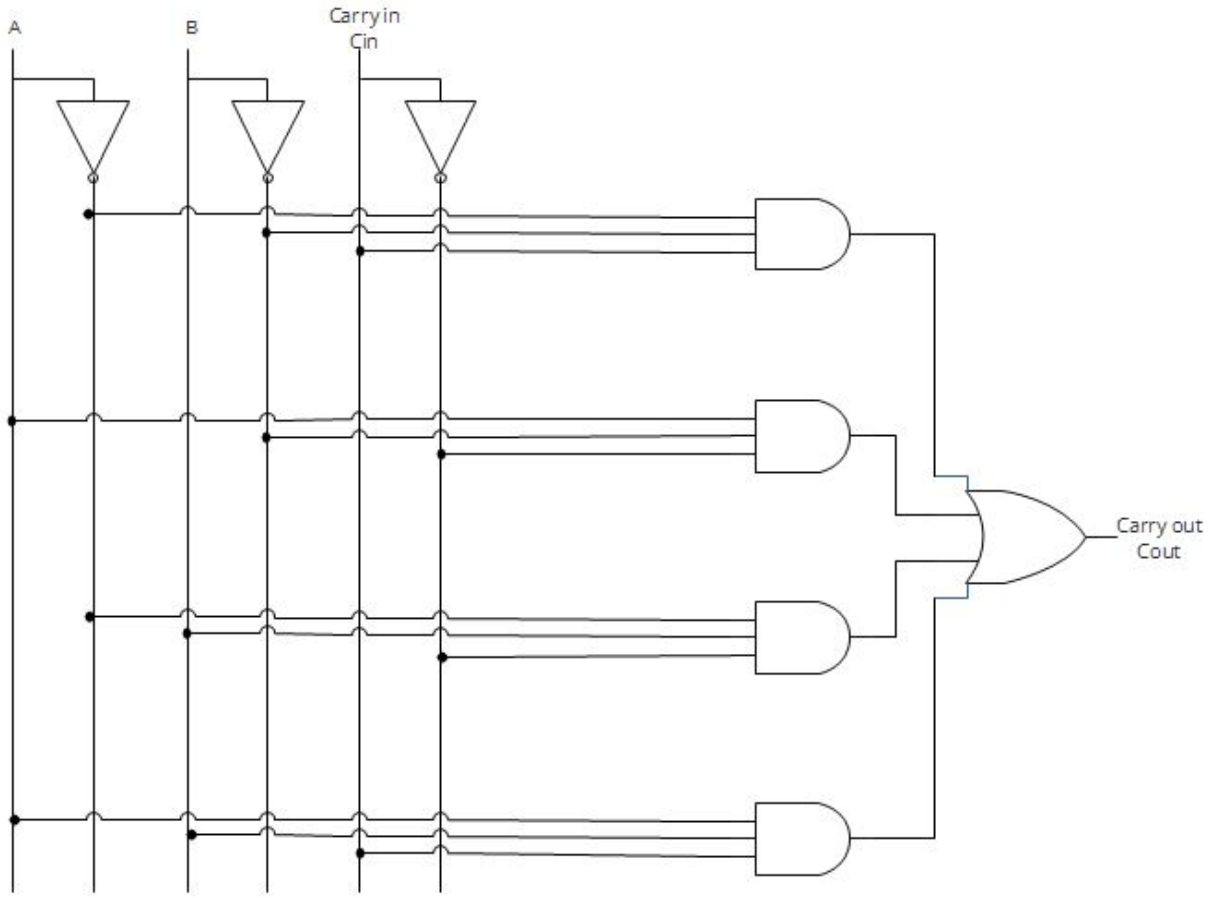
3. Full Adder

The Full Adder has two separate output statements, the carry out and the final output. These are represented in different equations and circuit diagrams.

Carry Out Equation

$$C_{out} = \bar{A}\bar{B}C_{in} + A\bar{B}\bar{C}_{in} + \bar{A}B\bar{C}_{in} + ABC_{in}$$

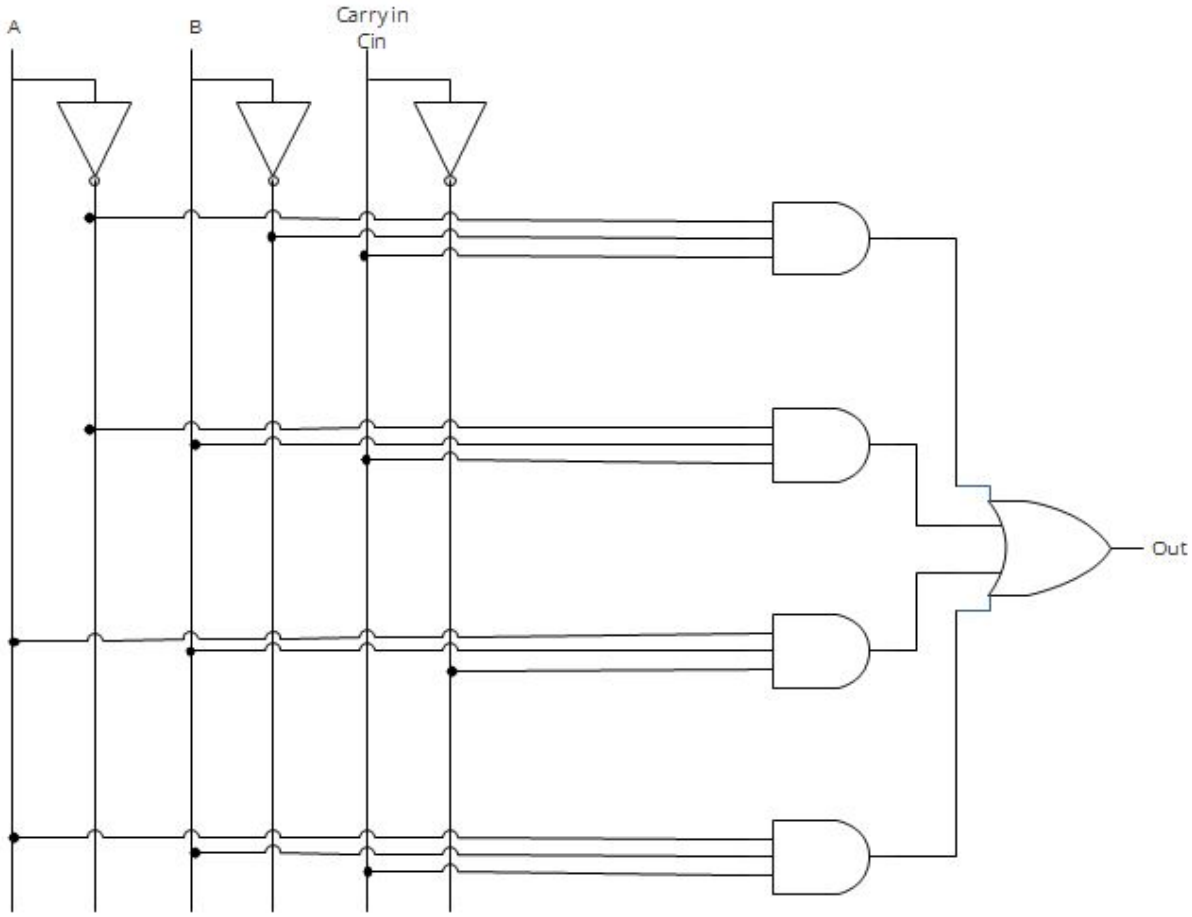
Carry Out Circuit Diagram



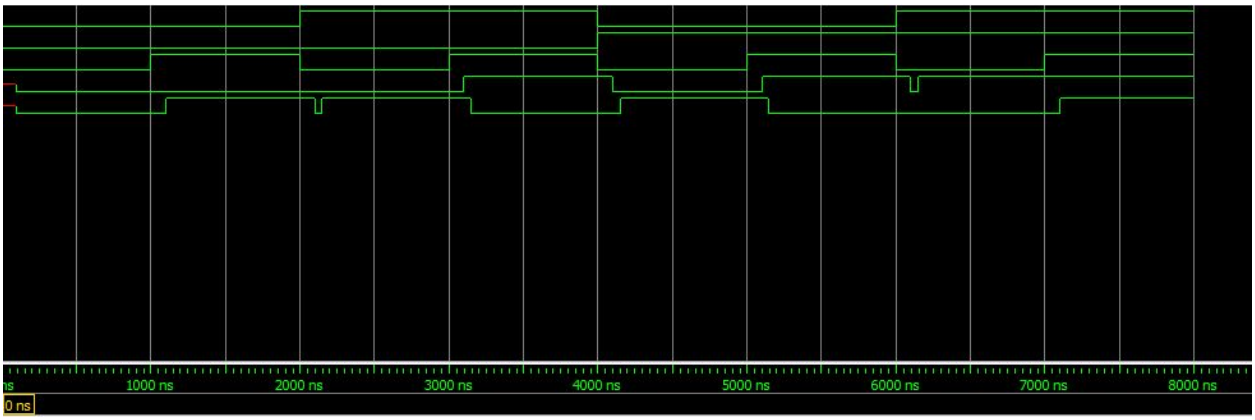
Output Equation

$$Out = A\bar{B}C_{in} + \bar{A}BC_{in} + AB\bar{C}_{in} + ABC$$

Output Circuit Diagram



Waveform



Test Bench

A	B	Cin	Cout	Output	Expected Output
0	0	0	0	0	0 0
0	0	1	0	1	0 1
1	0	0	0	1	0 1
1	0	1	1	0	1 0
0	1	0	0	1	0 1
0	1	1	1	0	1 0
1	1	0	1	0	1 0
1	1	1	1	1	1 1