Fall 2018

California State University, Northridge

Department of Electrical & Computer Engineering

Experiment 11
Adder and Magnitude Comparator

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ECE 320L

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Introduction:

The purpose of the experiment is to understand how to design,build, and analyze circuits with binary adders and magnitude comparators to use convert number systems. This experiment considers the conversion of binary input to BCD and excess-3 code.

Equipment used:

Type	Model	Serial No.	Calibration Date
Power Supply	Tektronix PWS2323	MY48004846	N/A
Digital Multimeter	Tektronix CDM250	DM 250TWS2380	N/A

Parts Used:

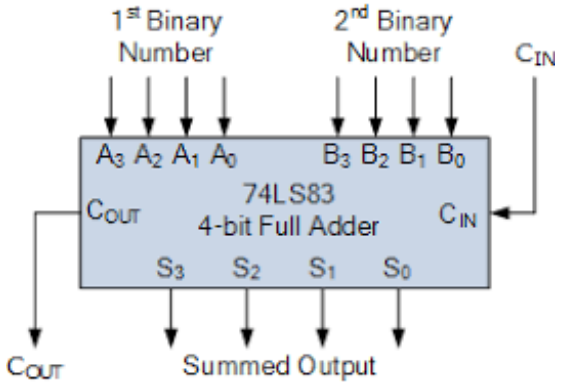
QTY	Component	Value
5	Resistor	330Ω
1	7404 Hex Inverter	N/A
8	Resistor	1kΩ
1	7483A binary adder	N/A
1	7485 Comparator	N/A
5	LEDS	N/A

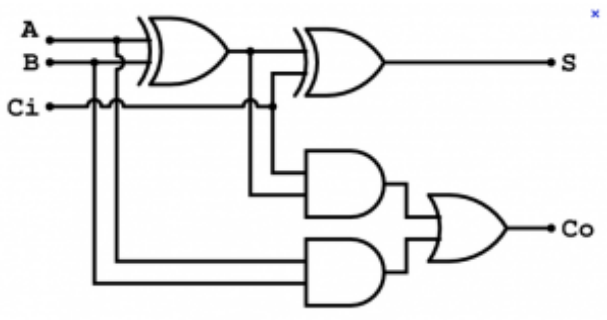
Software Used:

1. Google Docs
2. Krita
3. Snipping Tool
4. Google Sheets

Theory:

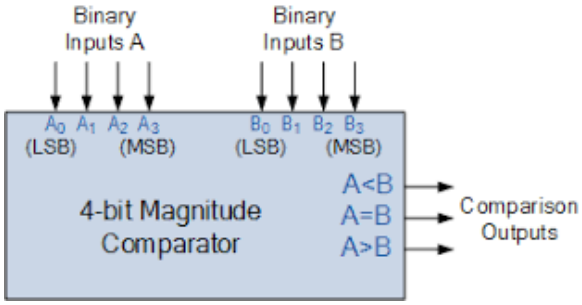
7483a 4-bit binary adder

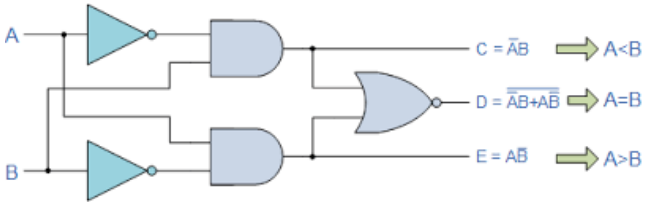




Input			Output	
A	B	Cin	Sum	Carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

7485 magnitude comparator





Procedure & Results:

The schematic for figure 11-2 was completed.

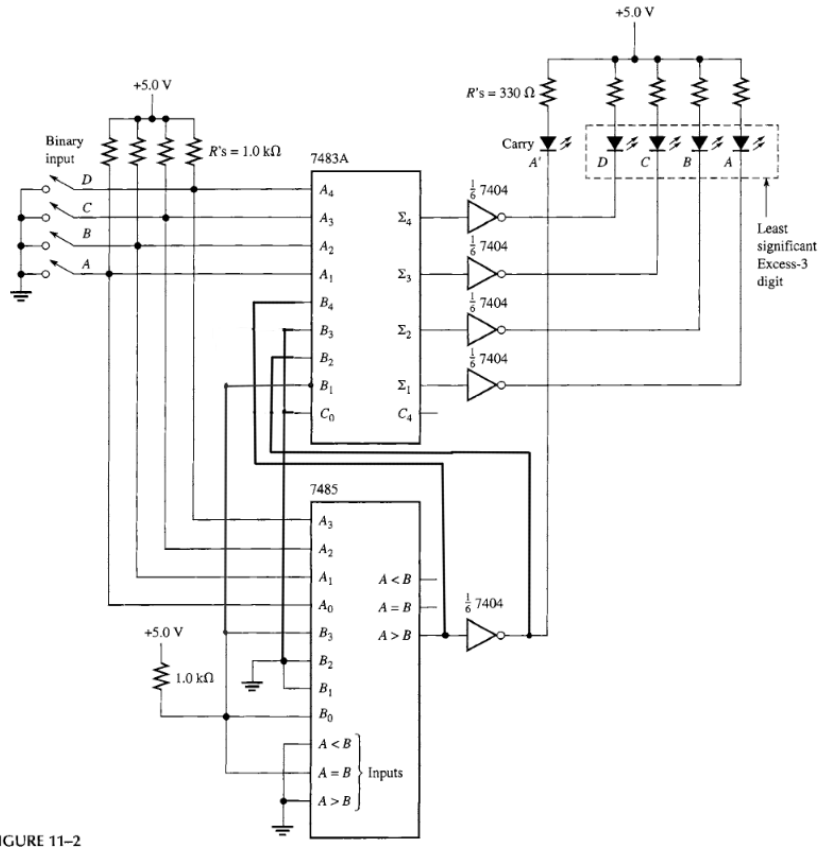


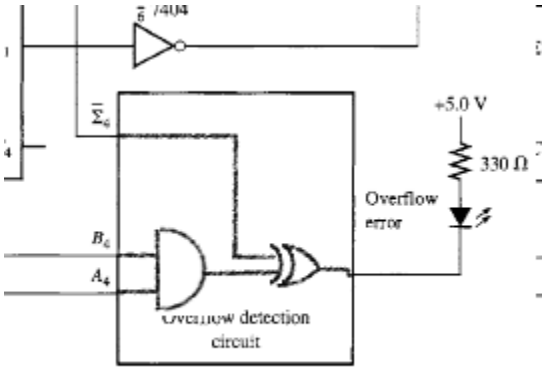
FIGURE 11–2
Binary to Excess-3 converter.

The schematic was then built and its outputs were tested and recorded in Table 11-4.

TABLE 11–4
Truth table for Figure 11–2.

Inputs (Binary)				Outputs Excess-3				
D	*C*	*B*	*A*	*A'*	*D*	*C*	*B*	*A*
0	0	0	0	0	0	0	1	1
0	0	0	1	0	0	1	0	0
0	0	1	0	0	0	1	0	1
0	0	1	1	0	0	1	1	0
0	1	0	0	0	0	1	1	1
0	1	0	1	0	1	0	0	0
0	1	1	0	0	1	0	0	1
0	1	1	1	0	1	0	1	0
1	0	0	0	0	1	0	1	1
1	0	0	1	0	1	1	0	0
1	0	1	0	1	0	0	1	1
1	0	1	1	1	0	1	0	0
1	1	0	0	1	0	1	0	1
1	1	0	1	1	0	1	1	0
1	1	1	0	1	0	1	1	1
1	1	1	1	1	1	0	0	0

A circuit for detecting overflow for a 4-bit signed binary adder was designed.

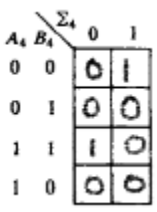


The truth table 11-5 for the the overflow error was completed.

Sign Bits			Error
A_4	B_4	Σ_4	X
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

The Karnaugh map figure 11-5 was completed.

And the boolean expression for the overflow error was simplified using the Karnaugh map.



$X = A_4B_4 \oplus \sum_4$

Conclusions:

The experiment was a success as the design and construction of the the final circuit was a success. The truth tables results show the exact same outputs that are expected to be seen in theory. When constructing the circuit trouble was seen when displaying the carry, but was solved once all inputs had been checked and properly grounded. For further investigation, the carry for the signed bit was correctly designed, and its boolean expression was properly identified. The experiment was a success in understanding the use and application of binary adders and magnitude comparators.