

Introduction to Digital Systems

Lab3

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Induction

This lab focuses on the two inputs add together and gives a output show as a signed or unsigned value. We also have to consider about $X+(-Y)$ on three situations: either $X=Y$, $X>Y$ or $X<Y$.

Part. 1

During this part, we are analysis two inputs meet $X+(-Y) < 0$, the LED would light up in signed. I did this part base on the light not meet $S=0$ or $S>0$, which means make a component meet $S<1$ is 1, $S=0$ is 0 and $S>1$ is 0 the LED would light up response we meet the require.

Part. 2

Over here, I would describe about how to build $S > 0$. First of all, $X+(-Y)>0$ is one situation we have to include. In other way, we are think about in which situation this result goes wrong, so there are two ways: when $X>0$ and $Y<0$ (this one may get a negative value), when $X<0$ and $Y>0$ (this may result overflow). In this way, we use $X>0$ and $Y<0$ become two inputs and be part of final result which can avoid get negative value. Except that, to avoid $X<0$ and $Y>0$ comes overflow, we have to use not ($X<0$ and $Y>0$) connect $X+(-Y)>0$ together another part of final result. And then we use OR gate connect those two part. We are almost done, but we still have to think about $X+(-Y)$ not equal to 0, so we add a AND at the end to meet $X+(-Y)$ would not light up when $X+(-Y)=0$.

Part. 3

X Uns	Y Uns	U<	U	U>	X Sig	Y Sig	<S	S	>S
0000 0001	0000 0010	1	0	0	0000 0001	0000 0010	1	0	0
1000 0101	1000 0101	0	1	0	1000 0101	1000 0101	0	1	0
1110 1010	1010 1100	0	0	1	1110 1010	1010 1100	0	0	1
0111 0010	1111 0010	1	0	0	0111 0010	1111 0010	0	0	1
1011 1001	0010 0101	0	0	1	1011 1001	0010 0101	1	0	0
0010 0101	1011 1001	1	0	0	0010 0101	1011 1001	0	0	1
0000 0000	1111 1111	1	0	0	0000 0000	1111 1111	0	0	1
0000 0000	0000 0000	0	1	0	0000 0000	0000 0000	0	1	0

As you can see, this table prove our gate are right. It meet the require for each situation ($X=Y$ for signed and unsigned, $X>Y$ for signed and unsigned, $X<Y$ for signed and unsigned).

Part. Bonus

X Uns	Y Uns	U<	U	U>	X Sig	<S	S	>S
1000 0000	1000 0000	0	1	0	1000 0000	0	1	0
0000 0000	1000 0000	1	0	0	0000 0000	1	0	0
0111 1111	1000 0000	1	0	0	0111 1111	1	0	0
0111 0010	1111 0010	1	0	0	0111 0010	1	0	0

In this part, we are testing the negation error would happen or not on $Y=-128$, I choose three special values: 0, -128, and 127 to test $X+(-Y)$. From the table, there does not have any error comes out, but we know $-(-128)$ would error on add one, which means error is happen 127 +1 for Y. The reason for our lab do not have error is add 1 is apply on whole equation not on Y, so it wouldn't have error.