

SCRAP WORK DO NOT REFER

Binary	Unsigned Decimal	Signed Decimal (2's Complement)	Signed Decimal (1's Complement)	Signed Decimal (Excess-128)	BCD
01110110	118	+118	+118	-10	76
00000000	0	+0	+0	-128	+0
11111111	255	-1	-0	127	NA
01111111	127	+127	+127	-1	NA
10000000	128	-128	-127	0	+80
01001001	73	+73	+73	-55	+49
10010100	148	-108	-107	20	+94

$$\begin{array}{r} 2^8 - 1 \\ 2^7 - 1 \\ 2^7 \\ 1 + 2^3 + 2^6 \\ 2^2 + 2^4 + 2^7 \end{array}$$
$$\begin{array}{r} 1101011 \\ \times \quad 1 \\ \hline -1101100 = -68 \end{array}$$

|| 010 ||

2's complement										
A	Binary Value	0101	0110	0000	1111 ₀₀₀	1000 ₁₁₁	1110 ₀₀₁	0100	1100 ₀₁₁	1001 ₀₁₀
	Unsigned Decimal Value	5	6	0	15	8	14	4	12	9
	Signed Decimal Value	+5	+6	0	-1	-8	-2	+4	-4	-7
B	Binary Value	1101 ₀₁₀	0001	1000 ₁₁₁	0100	1000	1111 ₀₀₀	0110	1011 ₁₀₀	0111
	Unsigned Decimal Value	13	1	8	4	8	15	6	11	7
	Signed Decimal Value	-3	1	-8	+4	-8	-1	+6	-5	4
A ? B	Unsigned < = >	<	>	<	>	=	<	<	>	>
	Signed < = >	>	>	<	=	<	<	>	<	<
A + B	Binary Value	0010	0111	1000	0011	0000	1101	1010	0111	0000
	Carry	Y	N	N	Y	Y	Y	N	Y	Y
	Unsigned Decimal Value	2	7	8	3	0	13	10	7	0
	Unsigned Overflow	Y	N	N	Y	Y	Y	N	Y	Y
	Signed Decimal Value	+2	7	-8	+3	0	-3	-6	+7	0
	Signed Overflow	N	N	N	N	Y	N	N	Y	N
A - B	Binary Value	1000	0101	1000	1011	0000	1111	1110	0001	0010
	Borrow	Y	N	Y	N	N	Y	Y	N	N
	Unsigned Decimal Value	8	5	8	11	0	15	14	1	2
	Unsigned Overflow	Y	N	Y	N	N	Y	Y	N	N
	Signed Decimal Value	-8	+5	-8	-5	0	-1	-2	+1	+2
	Signed Overflow	Y	N	N	N	N	N	N	N	Y

2's complement

$$\begin{array}{r} 101010 \\ 010100 \\ \hline 111110 \end{array}$$

$$\begin{array}{r} 101010^{10} \\ \times \times \times 0 \\ \hline 1111 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \\ 1110 \\ 1111 \\ \hline 1101 \rightarrow 0010 \\ 0011 \end{array}$$

$$\begin{array}{r} 100 \\ 100 \\ \hline 200 \end{array}$$
$$\begin{array}{r} 111 \\ 100 \text{ f} \\ 011 \text{ f} \\ \hline 010 \end{array}$$
$$\begin{array}{r} 1110 \\ 1111 \\ \hline 0101 \end{array}$$

1111
011

1000
0002
1602
0111
1000

11011

100

$$\begin{array}{r} 1000 \\ 0 \\ \hline 1100 \\ 0 \end{array}$$

110x
1011

$$\begin{array}{r} 11 \\ 1111 \\ 70100 \\ \hline 0001 \end{array}$$
$$\begin{array}{r} 1110 \\ 0001 \\ \hline 1111 \end{array}$$
$$\begin{array}{r} 1100 \\ 0100 \\ \hline 10001 \end{array}$$
$$\begin{array}{r} 1001 \\ 1001 \\ \hline 0010 \end{array}$$

78

100

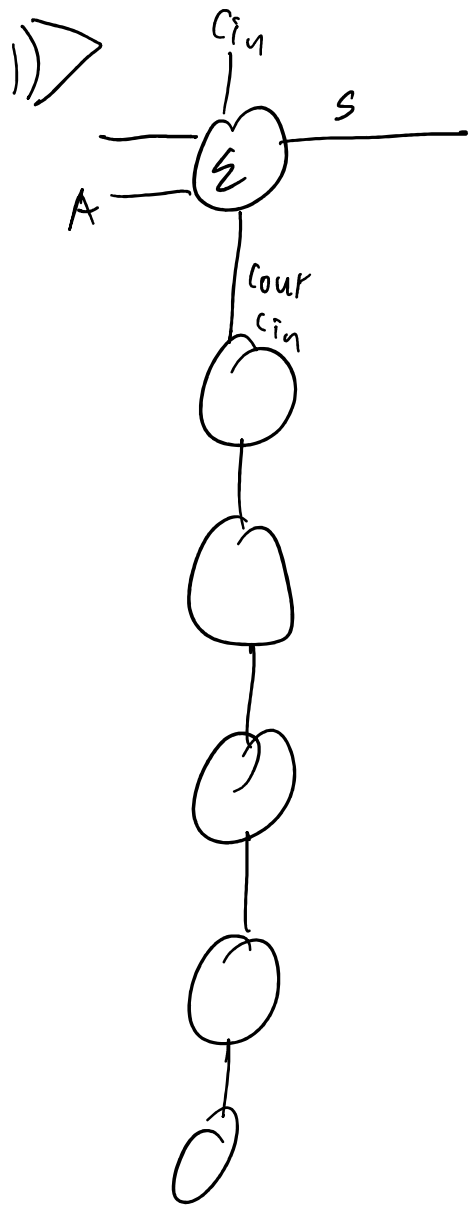
(Adding) (subtracting)

3) Adder/sub: Want either $A+B$ or $A+\bar{B}+1$
 (Adding) (subtracting)
 1=sub

B_0	Add/sub	B_{new}
0	1	1
0	0	0
1	1	0
1	0	1

= xor gate

Between bits don't need xor



- use xor to collect cin