

Digital Electronics

Assignment 4

Matt Cunningham

Assignment 4

a: $18 + (-7)$

$$18 \rightarrow 18 - 16 = 2 - 2 = 0$$

$$= 001000010010$$

$$7 \rightarrow 7 - 4 = 3 - 2 = 1 - 1 = 0$$

$$= 000000111$$

$$-7 \rightarrow = 11111001$$

$$\begin{array}{r} 111 \\ 00010010 \\ + 1111001 \\ \hline 000 \end{array}$$

$$\underline{00001011 = 11}$$

	128	64	32	16	8	4	2	1
18	0	0	0	1	0	0	1	0
7	0	0	0	0	0	1	1	1
21	0	0	0	1	0	1	0	2
13	0	0	0	0	1	1	0	1
118	0	1	1	1	0	1	1	0
54	0	0	1	1	0	1	1	0
59	0	0	1	1	1	0	1	1
96	0	1	1	0	0	0	0	0
12	0	0	0	0	0	1	1	0
6	0	0	0	0	0	0	1	1
32	0	0	1	0	0	0	0	0
18	0	0	0	0	1	0	0	1
388	0	0	1	0	0	1	1	0
28	0	0	0	1	1	1	0	0
125	0	1	1	1	1	1	0	1
66	0	1	0	0	0	0	1	0
36	0	0	1	0	0	1	0	0
48	0	0	1	1	0	0	0	0
36	0	0	1	1	0	0	0	0

b) $21 + (-13)$

$$21 \rightarrow 21 - 16 = 5 - 4 = 1 - 1 = 0$$

$$= 00010101$$

$$-13 \rightarrow 13 - 8 = 5 - 4 = 1 - 1 = 0$$

$$= 00001101$$

$$-13 \rightarrow \cancel{1111001} + 11110011$$

$$\begin{array}{r} 111111 \\ 00010101 \\ + 11110011 \\ \hline 00001000 = 8 \end{array}$$

$$c: 118 + (-54)$$

$$118 \rightarrow 118 - 64 = 54 - 32 = 22 - 16 = 6 - 4 = 2 - 2 = 0$$

$$54 \rightarrow 54 - 32 = 22 - 16 = 6 - 4 = 2 - 2 = 0$$

$$118 = 01110110, 54 = 00110110$$

$$-54 = 11001010$$

$$\begin{array}{r} 00\ 01110110 \\ + 11001010 \\ \hline 01000000 = 64 \end{array}$$

$$d) 59 + (-96)$$

$$59 \rightarrow 59 - 32 - 16 - 8 - 2 - 1 = 0$$

$$59 = 00111011$$

$$96 \rightarrow 96 - 64 - 32 = 0$$

$$96 = 01100000$$

$$-96 = \cancel{100111} - 10011111$$

$$= 10100000$$

$$\begin{array}{r} 00111011 \\ + 10100000 \\ \hline 11011011 = -37 \end{array}$$

e) $12 + (-6)$

88 (8)

$$12 \rightarrow 12 - 8 - 4 = 0$$
$$= 00001100$$

$$6 \rightarrow 6 - 4 - 2 = 0$$
$$= 00000110$$

$$-6 \rightarrow \begin{array}{r} 1111100 \\ \overset{1s}{\cancel{1}} \end{array} \rightarrow \begin{array}{r} 11111010 \\ \overset{2s}{\cancel{0}} \end{array}$$

$$\begin{array}{r} 00001100 \\ + \begin{array}{r} 11111010 \\ \hline 00000110 \end{array} \end{array} = 6$$

f) $32 + (-18)$

~~18~~ $32 \rightarrow 32 - 32 = 0$
$$= 00100000$$

$$18 \rightarrow 18 - 16 - 2 = 0$$

$$= 00010010$$

$$-18 \rightarrow \begin{array}{r} 11101101 \\ \overset{1s}{\cancel{1}} \end{array} \rightarrow \begin{array}{r} 11101110 \\ \overset{2s}{\cancel{1}} \end{array}$$

$$\begin{array}{r} 00100000 \\ + \begin{array}{r} 11101110 \\ \hline 00001110 \end{array} \end{array} = 14$$

$$g) 38 + (-28)$$

(8+) + 28 (i)

$$38 \rightarrow 38 - 32 - 4 - 2 = 0$$

= 00100110

$$28 \rightarrow 28 - 16 - 8 - 4 = 0$$

= 00011100

$$-28 \rightarrow 111000011 \xrightarrow{1s} 11100100$$

$\begin{array}{r} 00100110 \\ + 11100100 \end{array}$

$\underline{+ 11100100} = 00001010$

$= 10$

$$h) 125 + (-66)$$

$$125 \rightarrow 125 - 64 - 32 - 16 - 8 - 4 - 1 = 0$$

$$66 \rightarrow 66 - 64 - 2 = 0$$

$$-66 \rightarrow 10111101 \xrightarrow{1s} 10111110$$

$\begin{array}{r} 1111 \\ 0111101 \end{array}$

$\underline{+ 10111110} = 00000011$

$$10111110 \xrightarrow{2s} 10111110$$

$\begin{array}{r} 10111110 \\ + 10111110 \end{array} = 59$

$$i) 36 + (-48)$$

$$36 \rightarrow 36 - 32 - 4 = 0 = 00100100$$

$$48 \rightarrow 48 - 32 - 16 = 0 = 00110000$$

$$-48 \rightarrow \begin{array}{r} 1s \\ 11001111 \end{array} \rightarrow \begin{array}{r} 2s \\ 11010000 \end{array}$$

$$\begin{array}{r} 00100100 \\ + 11010000 \\ \hline 11110100 = -12 \end{array}$$

$$j) (-36) + (-48)$$

$$36 \rightarrow 36 - 32 - 4 = 0 = 00100100$$

$$48 \rightarrow 48 - 32 - 16 = 0 = 00110000$$

$$-36 \rightarrow \begin{array}{r} 1s \\ 11011011 \end{array} \rightarrow \begin{array}{r} 2s \\ 11011100 \end{array}$$

$$-48 \rightarrow \begin{array}{r} 1s \\ 11001111 \end{array} \rightarrow \begin{array}{r} 2s \\ 11010000 \end{array}$$

$$\begin{array}{r} 11011100 \\ + 11010000 \\ \hline 10101100 = -84 \end{array}$$