

1) A is a Full adder, B is two half adders

Truth table A

C	x	y	C+1	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

$S = \bar{x} \bar{y} \oplus C$ $CH = xy + C(xy)$

C	x	y	CH	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

$S = x \oplus y \oplus C$ $CH = xy + C(x \oplus y)$

C	x	y	CH	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

✓ all truth tables are identical

2)

x	y	w	r	w _{in}
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

$r = \bar{x} \bar{y} w + \bar{x} y \bar{w} + x \bar{y} \bar{w} + x y w$

$w_{in} = \bar{x} \bar{y} w + \bar{x} y \bar{w} + \bar{x} y w + x y w \Rightarrow$

$\bar{x} w + \bar{x} y \bar{w} + y w \Rightarrow$

$\bar{x} y \bar{w} + w(\bar{x} + y)$

Class 16

- 1) a) 001010 \Rightarrow 110110
 b) 110011 \Rightarrow 001101
 c) 100100 \Rightarrow 011100
 d) 010001 \Rightarrow 101111

- 2) a) -15 \Rightarrow 1111 \Rightarrow 10001
 b) -16 \Rightarrow 1010 \Rightarrow 10110
 c) 0 \Rightarrow 0000 \Rightarrow 00000
 d) 7 \Rightarrow 0111 \Rightarrow 00111

- 3) a) -21, as the most significant bit represents -1
 b) 001010 \Rightarrow 10
 c) 001011 \Rightarrow 11

Class 17 1)

a) 01111 + 01010

Carry	0	1	1	0	0
	0	1	1	1	1
+	0	1	0	1	0
	1	1	0	0	1

Carries: 0
 Overflow: 1

b) 11000 + 01101

Carry	1	1	0	0	0
	1	1	0	0	0
+	0	1	1	0	1
	1	0	0	1	0

Carries: 1
 Overflow: 0

c) 01010 - 11101 \Rightarrow 2)

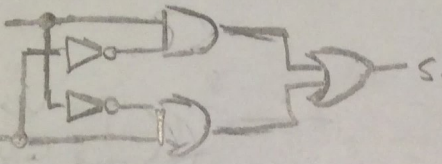
Carry	0	0	0	0	0
	0	1	0	1	0
-	0	0	0	1	1
	0	1	0	1	1

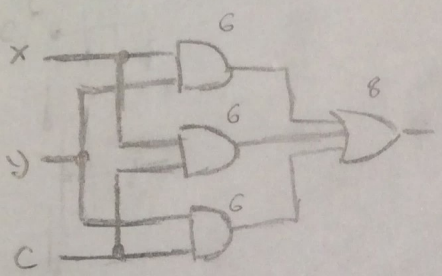
Carries: 0
 Overflow: 0

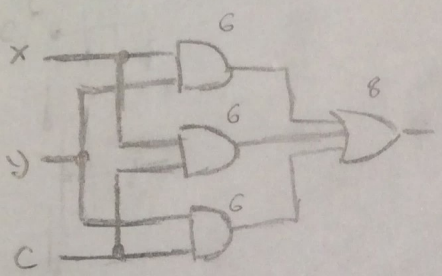
2)

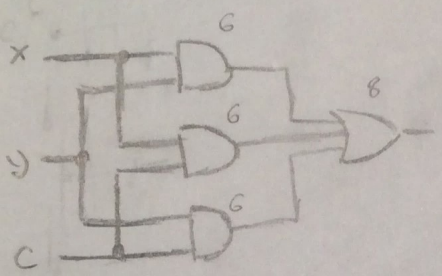
a) 14 transistors

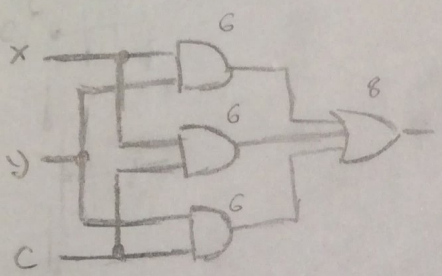
b) 34 transistors

c) A  22 transistors

B  48 transistors

X  26 transistors

Y  26 transistors

C  26 transistors

d) 32 Full adders = 32 * 34 transistors = 1,088 transistors