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7-Oct-2014  
Digital Logic Assn #2

Problems:

Ch 1: 9, 11, 14, 16, 17, 19-22

Ch 2: 1, 3, 4, 5, 6, 8, 9, 10-12

Chapter 1:

9)

11101101

11101101  
neg.

1101101

1. Type: Signed

2. Word count: 8 bit

3. Representation: 2's Compl.

$$= 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0$$

$$\begin{aligned} &= 64 + 32 + 16 + 8 + 4 + 1 \\ &= 109 \end{aligned}$$

Decimal value = -109

11)  $1019_{10}$  to Hex

$$1019_{10} = 111111011$$

111111011  
00

$$= 00111111011$$

3 F B

3FB<sub>16</sub>

14)  $0xFAB$  to decimal

$$\begin{array}{ccc} F & A & B \\ = 1111 & 1010 & 1011 \\ = 15 & 10 & 11 \\ = 15 \cdot 16^2 + 10 \cdot 16^1 + 11 \cdot 16^0 \\ = \boxed{4011} \end{array}$$

16) To hex

1011 1010 1011 1110  
*Invert add w/ Method*

1. Type: Signed
2. Size: 16bit
3. Repn: 2's Compl

$$\begin{array}{r} 0100\ 0101\ 0100\ 0001 \\ + \qquad \qquad \qquad \qquad | \\ \hline 0100\ 0101\ 0100\ 0010 \end{array}$$

$$256 \text{ const.} = 0100\ 0101\ 0100\ 0010$$

$$= 4 \quad 5 \quad 4 \quad 2$$

$$= \boxed{4542_{16}}$$

17) Convert 0x871 to signed decimal

0x871

8      7      1  
1000 0111 0001

neg.

$$= 0000 \quad 0111\ 001$$

$$= 2^6 2^5 2^4 2^3 2^2 2^1 \\ = 01 \ 11 \ 001$$

$$= 32 + 16 + 8 + 1$$

$$\cancel{-} 512$$

$$\rightarrow = \cancel{-} 512$$

$$= -871$$

$$= 8 \cdot 16^2 + 7 \cdot 16^1 + 1 \cdot 16^0$$

$$= 2161$$

$$= -2161_0$$

1000 0111 0001

>>> invertcccc

0111 1000 1110

>>> add oneccccc +1

0111 1000 1111

$$2^6 2^5 2^4 2^3 2^2 2^1 2^0$$

$$0111 1000 1111$$

$$= 1024 + 512 + 256 + 128 + 8 + 4 + 2 + 1$$

$$= 1935$$

1. Type: Signed
2. SF20: 12 bits
3. Reprs: 2's compl.

19)

An  $N$ -bit 2's complement can represent every integer in the range

$$-(2^{(N-1)}) \text{ to } +(2^{N-1})$$

$$= [-2048 \text{ to } +2047]$$

20) 1111 0100 1110 to decimal

\* See end of  
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~~Chapter~~  
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1. Not defined
2. 12-bits
3. 2's Complement

21)  $-227_{10}$  to binary

$$\begin{array}{r} \text{neg} \rightarrow - \\ \downarrow \\ 227 \\ - 2048 \\ \hline -227 \\ - 128 \\ \hline -15 \\ - 64 \\ \hline -31 \\ - 32 \\ \hline -1 \\ \hline \end{array}$$

$$\begin{array}{r} 1096 \\ 512 \\ 256 \\ 128 \\ 64 \\ 32 \\ 16 \\ 8 \\ 4 \\ 2 \\ 1 \\ \hline 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \end{array}$$

$227_{10} = 0100011011111$

>>> Invert all  
1011100100000

>>> add 1 all  
1011100100001

$$-227_{10} = 1011100100001_2$$

Chapter 1  
#22)

$$\begin{array}{r} 1111 \quad 0100 \quad 1110 \\ \downarrow \text{neg} \\ - \\ 0000 \quad 1011 \quad 0001 \\ \hline 1011 \quad 0010 \end{array}$$

178

negative

-178

$$22) -227_{10} = \underbrace{1011}_{\text{Fill}} \underbrace{00100000}_{12}$$

$$= 0001 \ 111 \ 0010 \ 0001$$

Chapter 2:

$$D \rightarrow (A \vee B) \wedge (\neg B \vee C) \vee D$$

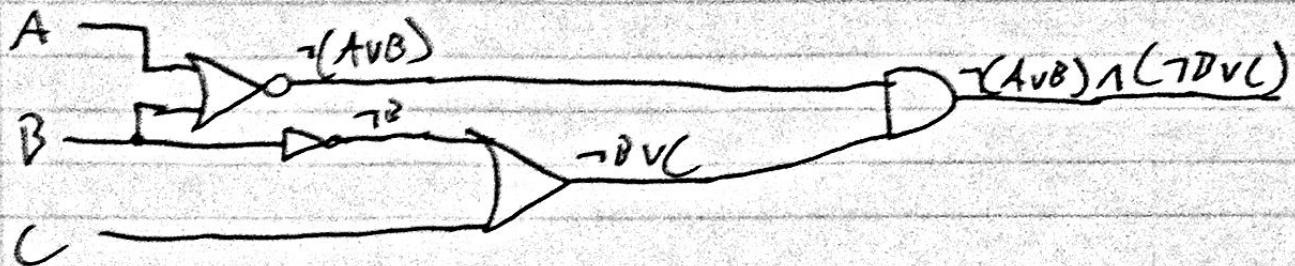
$$A=0 \quad C=1$$

$$B=1 \quad D=0$$

$$\begin{aligned} & \neg(0 \vee 1) \wedge (\neg 1 \vee 1) \vee 0 \\ & (1 \wedge 0) \wedge (0 \vee 1) \vee 0 \\ & (0 \wedge 1) \vee 0 \\ & 0 \vee 0 \\ & 0 \end{aligned}$$

Chapter  
\*soft min comment down

$$3) \neg(A \vee B) \wedge (\neg B \vee C)$$



$$4) \neg(A \vee B) \wedge (\neg B \vee C)$$

A	B	C	$A \vee B$	$\neg(A \vee B)$	$\neg B$	$\neg B \vee C$	$\neg(A \vee B) \wedge (\neg B \vee C)$
0	0	0	0	1	1	1	1
0	0	1	0	1	1	1	1
0	1	0	1	0	0	0	0
0	1	1	1	0	0	1	0
1	0	0	1	0	1	1	0
1	0	1	1	0	1	1	0
1	1	0	1	0	0	0	0
1	1	1	1	0	0	1	0

$$5) A \wedge ((\neg B) \vee (\neg C)) \vee (\neg C \wedge B)$$

- a)  $A((\neg B) \vee (\neg C)) \vee (\neg C B)$
- b)  $A((\neg B) + (\neg C)) + (\neg C B)$
- c)  $A(\bar{B}) + (\bar{C}) + (\bar{C} B)$

$$6) A \vee ((\neg B) \vee (\neg C)) \vee (\neg C \wedge B)$$

	A	B	C	$\neg B$	$\neg C$	$((\neg B) \vee (\neg C))$	$A \vee ((\neg B) \vee (\neg C))$	$\neg C \wedge B$	$A \vee (\neg B) \vee (\neg C) \vee (\neg C \wedge B)$
7	0	0	0	1	1	1	1	0	1
7	0	0	1	1	0	1	1	0	1
7	0	1	0	0	1	1	1	1	1
7	0	1	1	0	0	0	0	0	0
7	1	0	0	1	1	1	1	0	1
7	1	0	1	1	0	1	1	0	1
7	1	1	0	0	1	1	1	1	1
7	1	1	1	0	0	0	0	0	1

$$8) A \vee ((\neg B) \vee (\neg C)) \vee (\neg C \wedge B) \text{ to DNF or sum of products :}$$

Sum of Products:

$$\begin{aligned}
 & + \overline{A} \overline{B} \overline{C} \\
 & + \overline{A} \overline{B} C \\
 & + \overline{A} B \overline{C} \\
 & + A \overline{B} \overline{C} \\
 & + A \overline{B} C \\
 & + A B \overline{C} \\
 & + A B C
 \end{aligned}$$

	A	B	1
	0	0	1
	0	1	1
	1	0	1
	1	1	1

Sum of Products:

$$\begin{aligned}
 & + \overline{A} \overline{B} \\
 & + \overline{A} B \\
 & + A \overline{B} \\
 & + A B
 \end{aligned}$$

$$\neg(A \wedge B) \quad \neg A \vee \neg B$$

10)  $\text{Nand} \equiv \text{Not}$

A, B	$A \wedge B$	$\neg A$	$\neg B$	Aft Nand	$\neg(A \wedge B)$
0 0	0	1	1	1	1
0 1	0	1	0	1	1
1 0	0	0	1	1	1
1 1	1	0	0	0	0

Equivalent ✅

11)  $\text{And} \equiv \text{Nand}$

A, B	$A \wedge B$	Nand	$\neg(\text{Nand})$
0 0	0	1	0
0 1	0	1	0
1 0	0	1	0
1 1	1	0	1

Equivalent ✅

12)  $\text{Or} \equiv \text{Nand}$

A, B	$A \vee B$	Nand	$\neg A$	$\neg B$	$(\neg A \vee \neg B)$
0 0	0	1	1	1	1
0 1	1	1	1	0	1
1 0	1	1	0	1	1
1 1	1	0	0	0	0

Equivalent ✅