Brian Faure DLD Hw #2 BUID: 150003563 Sept. 15 2014

#1) Drill Problems 2.6 - 2.12

2.6) Perform following number system conversions

a.) $125_{10} = ?_2$ 125

$\div 2 = 62$ R = 1

$\div 2 = 31$ R = 0

$\div 2 = 15$ R = 1

$\div 2 = 7$ R = 1

$\div 2 = 3$ R = 1

$\div 2 = 1$ R = 1

$\div 1 = 1$ R = 1

$125_{10} = \boxed{1111101_2}$

b.) $3489_{10} = ?_8$ 3489

$\div 8 = 436$ R = 1

$\div 8 = 54$ R = 4

$\div 8 = 6$ R = 6

$\div 8 = 0$ R = 6

$3489_{10} = \boxed{6641_8}$

c.) $209_{10} = ?_2$ 209

$\div 2 = 104$ R = 1

$\div 2 = 52$ R = 0

$\div 2 = 26$ R = 0

$\div 2 = 13$ R = 0

$\div 2 = 6$ R = 1

$\div 2 = 3$ R = 0

$\div 2 = 1$ R = 1

$\div 1 = 1$ R = 1

$209_{10} = \boxed{11010001_2}$

d.) $9714_{10} = ?_8$ 9714

$\div 8 = 1214$ R = 2

$\div 8 = 151$ R = 6

$\div 8 = 18$ R = 7

$\div 8 = 2$ R = 2

$\div 8 = 0$ R = 2

$\boxed{22762_8}$

e.) $132_{10} = ?_2$ 132

$\div 2 = 66$ R = 0

$\div 2 = 33$ R = 0

$\div 2 = 16$ R = 1

$\div 2 = 8$ R = 0

$\div 2 = 4$ R = 0

$\div 2 = 2$ R = 0

$\div 2 = 1$ R = 0

$\div 2 = 0$ R = 1

$\boxed{132_{10} = 10000100_2}$

f.) $23851_{10} = ?_{16}$ 23851

$\div 16 = 1490$ R = 11 = B

$\div 16 = 93$ R = 2

$\div 16 = 5$ R = 13 = D

$\div 16 = 0$ R = 5

$23851_{10} = \boxed{5D2B_{16}}$

g.) $727_{10} = ?_5$ 727

$\div 5 = 145$ R = 2

$\div 5 = 29$ R = 0

$\div 5 = 5$ R = 4

$\div 5 = 1$ R = 0

$\div 5 = 0$ R = 1

$\boxed{10402_5}$

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h.) $57190_{10} = ?_{16}$ 57190

$\div 16 = 3574$ R = 6

$\div 16 = 223$ R = 6

$\div 16 = 13$ R = 15 = F

$\div 16 = 0$ R = 13 = D

$\boxed{DF66_{16}}$

i.) $1435_{10} = ?_8$ 1435

$\div 8 = 179$ R = 3

$\div 8 = 22$ R = 3

$\div 8 = 2$ R = 6

$\div 8 = 0$ R = 2

$\boxed{2633_8}$

j.) $65113_{10} = ?_{16}$ 65113

$\div 16 = 4069$ R = 9

$\div 16 = 254$ R = 5

$\div 16 = 15$ R = 14

$\div 16 = 0$ R = 15

$\boxed{FE59_{16}}$

* Drill Problem 2.7

a.) 110011
\+ 11010
1001101_2

b.) 100111
\+ 101010
1010001_2

c.) 11100011
\+ 10111101
101000000_2

d.) 1100110
\+ 1111001
11011111_2

* Drill Problem 2.8

a.) $\cancel{1}10011 - 11010 = 11001$

$b = 0110000$

b.) $\cancel{1}\cancel{1}00111 - 101010 = 111101$

$b = 1110000$

c.) $11\cancel{1}00011 - 01011101 = 10000110$

$b = 00111000$

d.) $\cancel{1}\cancel{1}100\cancel{1}\cancel{1}0 - 1111001 = 1101101$

$B = 11110010$

* Drill Problem 2.9

a.) $1776 + 1432 = 3430_8$

b.) $57734 + 1066 = 61022$

c.) $252757 + 465521 = 740500$

d.) $511042 + 57647 = 570711$

* Drill Problem 2.10

10 12 14
9 A B C D E F
11 13 15

a.) $1776 + 1432$
$= 2\,(11)(10)\,8$
$= \boxed{2BA8_{16}}$

b.) $4F1A5 + B805$
$= (5)\,(10)\,(10)\,(10)\,(7)$
$= \boxed{5AA7A_{16}}$

c.) $F35B + 27E6$
$= 11\,(11)\,4\,1$
$= \boxed{11B41_{16}}$

d.) $\begin{array}{r} \overset{1}{1}\ B\ \overset{1}{9}\ 0\ f \\ +\ \ C\ 4\ 4\ E \\ \hline 2\ (13)\ (13) \\ (7)\ \ (5) \end{array} = \boxed{27D5D_{16}}$

* Drill Problem 2.11

+25 → 25 ÷2 = 12 R=1
÷2 = 6 R=0
÷2 = 3 R=0
÷2 = 1 R=1
÷2 = 0 R=1

$25_{10} = 11001_2$

$\boxed{\text{Signed mag 8-Bit} = 00011001_2}$

Two's Comp: 00011001
→ 11100110 + 1 = $\boxed{11100111_2}$

One's Comp: 00011001
$\boxed{11100110_2}$

+120 → 120 ÷2 = 60 R=0
÷2 = 30 R=0
÷2 = 15 R=0
÷2 = 7 R=1
÷2 = 3 R=1
÷2 = 1 R=1
÷2 = 0 R=1

$120_{10} = 1111000_2$

$\boxed{\text{Signed 8-Bit} = 01111000_2}$

Two's: 01111000
$\begin{array}{r} \overset{111}{10000111} \\ +\ 00000001 \\ \hline \boxed{10001000_2} \end{array}$

$\boxed{\text{One's: } 10000111_2}$

+82 → 82

82_{10} = 1010010

÷2 = 41 R=0

÷2 = 20 R=1

÷2 = 10 R=0

÷2 = 5 R=0

÷2 = 2 R=1

÷2 = 1 R=0

÷2 = 0 R=1

$\boxed{\text{Signed} = 01010010_2}$

positive

Two's Comp = 01010010

10101101

+ 00000001

$\boxed{\text{Two's} = 10101110_2}$

$\boxed{\text{One's} = 10101101_2}$

-42 → 42

÷2 = 21 R=0

÷2 = 10 R=1

÷2 = 5 R=0

÷2 = 2 R=1

÷2 = 1 R=0

÷2 = 0 R=1 → 101010

$\boxed{\text{Signed} = 10101010}$

negative

Two's = 10101010

01010101 flipped

+ 00000001

$\boxed{\text{Two's} = 01010110_2}$ $\boxed{\text{Ones} = 01010101_2}$

-6 → 6 ÷ 2 = 3 R=0

÷2 = 1 R=1

÷2 = 0 R=1 = 110 → $\boxed{10000110_2}$

negative

signed 8-Bit

10000110

01111001

+00000001 = $\boxed{01111010_2 = \text{Two's}}$ $\boxed{0111101 = \text{ones}}$

-111 → 111 ÷ 2 = 55 R=1 → 1101111

÷2 = 27 R=1

÷2 = 13 R=1

÷2 = 6 R=1

÷2 = 3 R=0

÷2 = 1 R=1

÷2 = 0 R=1

$\boxed{11101111_2 = \text{Signed 8-Bit}}$

negative

11101111 flip

00010000+1 $\boxed{\text{ones} = 00010000_2}$

$\boxed{00010001 = \text{Two's}}$

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* Drill Problem 2.12

a.)
```
   11010100
 + 11101011
 ----------
  110111111
```
Overflow into 9th Bit

b.)
```
   10111111
 + 11011111
 ----------
  110011110
```
Overflow into 9th Bit

c.)
```
   01011101
 + 00110001
 ----------
   10001110
```
Positive + Positive = negative → so overflow

d.)
```
   01100001
 + 00011111
 ----------
   10000000
```
Positive + Positive = negative → overflow

* #2) Drill Problem 4.7 (a) - (d)

a.) Write truth table for $F = X' \cdot Y + X' \cdot Y' \cdot Z$

X	Y	Z	F
0	0	0	0
0	0	1	1
0	1	0	1
1	0	0	0
0	1	1	1
1	1	0	0
1	0	1	0
1	1	1	0

+(W·Y') + (W·Z)

b.) $f=(W'\cdot X)+(Y'\cdot Z')+(X'\cdot Z)$

W	X	Y	Z	f
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	1	0	0	1
1	0	0	0	1
0	0	1	1	1
0	1	1	0	1
1	1	0	0	1
0	1	0	1	1
1	0	1	0	0
1	0	0	1	0
0	1	1	1	1
1	1	1	0	0
1	0	1	1	1
1	1	0	1	0
1	1	1	1	0

c.) $f=(W'\cdot X)+(W\cdot(Y'+Z))$

W	X	Y	Z	f
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	1	0	0	1
1	0	0	0	1
0	0	1	1	0
0	1	1	0	1
1	1	0	0	1
0	1	0	1	1
1	0	1	0	0
1	0	0	1	1
0	1	1	1	1
1	1	1	0	0
1	0	1	1	1
1	1	0	1	1
1	1	1	1	1

d.) $F=(A\cdot B')+(B'\cdot C)+(C\cdot D')+(C\cdot A')$

A	B	C	D	F
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	1	0	0	0
1	0	0	0	1
0	0	1	1	1
0	1	1	0	1
1	1	0	0	0

A	B	C	D	F
0	1	0	1	0
1	0	1	0	1
1	0	0	1	1
0	1	1	1	1
1	1	1	0	1
1	0	1	1	1
1	1	0	1	0
1	1	1	1	0

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#3 Drill Problem 4.14

a.) $F = \sum_{X,Y,Z} (1, 3, 5, 6, 7)$

☆ = Distinguished 1 cell

Z \ XY	00	01	11	10
0	0	0	1 ☆	0
1	1	1	1	1

X	Y	Z	F	
0	0	0	0	→ 0
0	0	1	1	→ 1
0	1	0	0	→ 2
0	1	1	1	→ 3
1	0	0	0	→ 4
1	0	1	1	→ 5
1	1	0	1	→ 6
1	1	1	1	→ 7

$(XYZ) + (XYZ') \rightarrow XY$

$(XYZ) + (XY'Z) \rightarrow XZ$

$(X'Y'Z) + (X'YZ) \rightarrow X'Z$ — $XY + XZ + X'Z \rightarrow \boxed{XY + Z}$

b.) $F = \sum_{WXYZ} (1, 4, 5, 6, 7, 9, 14, 15)$

☆ = Distinguished one-cell

YZ \ WX	00	01	11	10
00	0	1	0	0
01	☆1	1	0	1☆
11	0	1	1	0
10	0	1	1	0

W	X	Y	Z	F	
0	0	0	0	0	0
0	0	0	1	1	1
0	0	1	0	0	2
0	0	1	1	0	3
0	1	0	0	1	4
0	1	0	1	1	5
0	1	1	0	1	6
0	1	1	1	1	7
1	0	0	0	0	8
1	0	0	1	1	9
1	0	1	0	0	10
1	0	1	1	0	11
1	1	0	0	0	12
1	1	0	1	0	13
1	1	1	0	1	14
1	1	1	1	1	15

$(W'XY'Z') + (W'XY'Z) \rightarrow (W'XY')$

$(W'X'Y'Z) + (WX'Y'Z) \rightarrow (X'Y'Z)$

$\rightarrow (XYZ)$

$\rightarrow (XYZ')$

$(W'XY') + (X'Y'Z) + (XYZ) + (XYZ')$

$\rightarrow \boxed{(W'XY') + (X'Y'Z) + (XY)}$

c.) $F = \prod_{WXY}(1,4,5,6,7)$

Y \ WX	00	01	11	10
0	1	1	0	0
1	0	1	0	0

$W'X'Y' + W'XY' \rightarrow W'Y'$

$\rightarrow W'X$

$= \boxed{(W'Y') + (W'X) \text{ or } W'(Y'+X)}$

W	X	Y	F	
0	0	0	1	0
0	0	1	0	1
0	1	0	1	2
0	1	1	1	3
1	0	0	0	4
1	0	1	0	5
1	1	0	0	6
1	1	1	0	7

d.) $F = \sum_{WXYZ}(0,1,6,7,8,9,14,15)$

*No Distinguished 1 cells

YZ \ WX	00	01	11	10
00	1	0	0	1
01	1	0	0	1
11	0	1	1	0
10	0	1	1	0

$(W'X'Y') + (WX'Y') \rightarrow (X'Y')$

$(W'XYZ) + (W'XYZ') \rightarrow (W'XY)$

$(WXYZ) + (WXYZ') \rightarrow (WXY)$

$= (X'Y') + (W'XY) + (WXY)$

$= \boxed{(X'Y') + (XY)}$

W	X	Y	Z	F	
0	0	0	0	1	0
0	0	0	1	1	1
0	0	1	0	0	2
0	0	1	1	0	3
0	1	0	0	0	4
0	1	0	1	0	5
0	1	1	0	1	6
0	1	1	1	1	7
1	0	0	0	1	8
1	0	0	1	1	9
1	0	1	0	0	10
1	0	1	1	0	11
1	1	0	0	0	12
1	1	0	1	0	13
1	1	1	0	1	14
1	1	1	1	1	15

e.) $F = \prod_{ABCD}(4, 5, 6, 13, 15)$

*No D-one Cells

CD \ AB	00	01	11	10
00	1	0	1	1
01	1	0	0	1
11	1	1	0	1
10	1	0	1	1

A	B	C	D	F	
0	0	0	0	1	0
0	0	0	1	1	1
0	0	1	0	1	2
0	0	1	1	1	3
0	1	0	0	0	4
0	1	0	1	0	5
0	1	1	0	0	6
0	1	1	1	1	7
1	0	0	0	1	8
1	0	0	1	1	9
1	0	1	0	1	10
1	0	1	1	1	11
1	1	0	0	1	12
1	1	0	1	0	13
1	1	1	0	1	14
1	1	1	1	0	15

$(A'B'C') + (A'B'C) \rightarrow (A'B')$

$(AC'D')$

$(AB'C'D) + (AB'CD) \rightarrow (AB'D)$

$(ABCD') + (AB'CD') \rightarrow (ACD')$

$= (A'B') + (ACD') + (AC'D')$
$+ (AB'D)$

$= (A'B') + (AD') + (AB'D)$

$= \boxed{(A'B') + (AD') + (AB')}$

f.) $F = \Sigma_{ABCD}(4, 5, 6, 11, 13, 14, 15)$

	A	B	C	D	F
0	0	0	0	0	0
1	0	0	0	1	0
2	0	0	1	0	0
3	0	0	1	1	0
4	0	1	0	0	1
5	0	1	0	1	1
6	0	1	1	0	1
7	0	1	1	1	0

	A	B	C	D	F
8	1	0	0	0	0
9	1	0	0	1	0
10	1	0	1	0	0
11	1	0	1	1	1
12	1	1	0	0	0
13	1	1	0	1	1
14	1	1	1	0	1
15	1	1	1	1	1

CD \ AB	00	01	11	10
00		1		
01		1		
11			1	1 ☆
10		1	1	

$(A'BC') + (BC'D) + (ACD)$
$+ (BCD')$

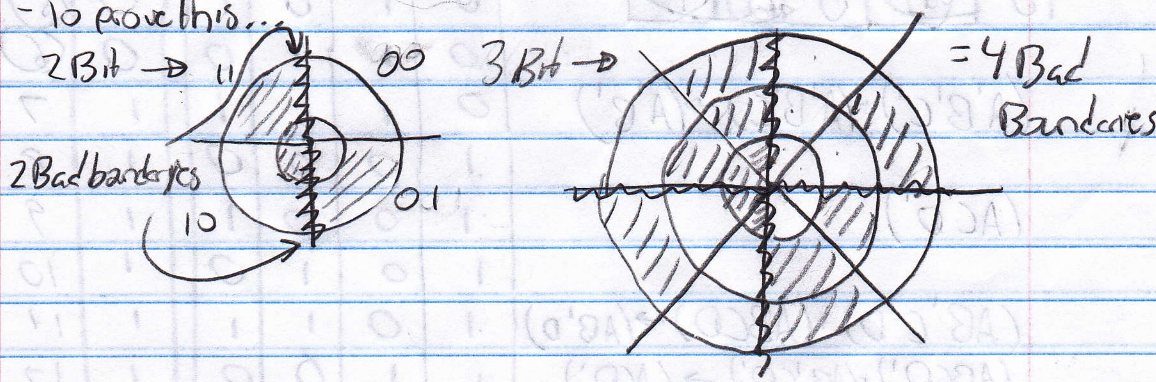
$= \boxed{(A'BC') + (BC'D) + (ACD) + (BCD')}$

#4) Exercise 2.36

- As a function of n, how many "bad" bandaries are there in a mechanical encoding disk that uses an n-bit binary code?
- With a "Bad" bandary described as an intersection changes more then just one bit, the amount of bad banderies increases as the following function...

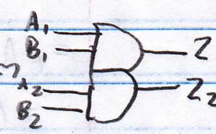
n = # of bits $\rightarrow$ $\boxed{f(n) = 2^{n-1}}$ = # of bad banderies

* - To prove this...



#5) Exercise 4.42

- Design 2 output, 4 input BUT gate with following diagram,



→ - If both upper inputs are one the upper output is one unless both lower inputs are one

→ - If both lower inputs are one the lower output is one unless both upper inputs are one.

A_1	B_1	A_2	B_2	Z_1	Z_2
0	0	0	0	0	0
0	0	0	1	0	0
0	0	1	0	0	0
0	0	1	1	0	1
0	1	0	0	0	0
0	1	0	1	0	0
0	1	1	0	0	0
0	1	1	1	0	1

A_1	B_1	A_2	B_2	Z_1	Z_2
1	0	0	0	0	0
1	0	0	1	0	0
1	0	1	0	0	0
1	0	1	1	0	1
1	1	0	0	1	0
1	1	0	1	1	0
1	1	1	0	1	0
1	1	1	1	0	0