DLD HW #1

1. Convert 42_{10} to:

a) Base 2 $\longrightarrow$ $42 - 32 = 10 - 8 = 2$

$$\frac{1}{2^5}\ \frac{0}{2^4}\ \frac{1}{2^3}\ \frac{0}{2^2}\ \frac{1}{2^1}\ \frac{0}{2^0}$$

32 16 8 4 2 1

$\boxed{101010_2}$

b) Base 5

$\frac{42}{5} = 8\ R\ 2$

$\frac{8}{5} = 1\ R\ 3$

$\frac{1}{5} = 0\ R\ 1$

$\boxed{132_5}$

c) Base 16

$\frac{42}{16} = 2\ R\ 10$

$\frac{2}{16} = 0\ R\ 2$

$\boxed{2A_{16}}$

2. Convert the following values to base 10:

a) ~~16~~

$$\frac{1}{2^7}\ \frac{0}{2^6}\ \frac{1}{2^5}\ \frac{1}{2^4}\ \frac{1}{2^3}\ \frac{0}{2^2}\ \frac{0}{2^1}\ \frac{1}{2^0}$$

$2^7 + 2^5 + 2^4 + 2^3 + 2^0 = 128 + 32 + 16 + 8 + 1 = \boxed{185_{16}}$

b) $4213_5 \rightarrow 4 \times 5^3 + 2 \times 5^2 + 1 \times 5^1 + 3 \times 5^0$

$= 4 \cdot 125 + 2 \cdot 25 + (5) + 3 = \boxed{558_{10}}$

c) $D3B_{16} \rightarrow (13 \cdot 16^2) + (3 \cdot 16^1) + (11 \cdot 16^0)$

$= 13(256) + 3(16) + 11(1) = \boxed{3387_{10}}$

3. $E17_{16}$ to binary & octal

$\overbrace{1110}^{E} \quad \overbrace{0001}^{1} \quad \overbrace{0111}^{7}$

$E17_{16} = \boxed{111000010111_2}$

$\underbrace{111}_{7}\underbrace{000}_{0}\underbrace{010}_{2}\underbrace{111}_{7}$

$E17_{16} = \boxed{7027_8}$

4. $32_{10} = 100000_2$

$23_{10} = 010111_2$

$\boxed{110111_2}$

$$\begin{array}{r} 100000 \\ +\,010111 \\ \hline 110111_2 \end{array}$$

5.

$$\begin{array}{r} 010111 \\ -\,100000 \\ \hline 110111 \end{array}$$

(2's compliment)

$23 - 32 = -9$

$-9 = -1001$

1's compliment: 110110

2's compliment: 110111

6. Simplify

a) $$W = \bar{A}\bar{B}C + BC + A\bar{B}C$$
$$= C(\bar{A}\bar{B} + B + A\bar{B})$$
$$= C(\bar{A} + B) + A\bar{B}C$$
$$= C\bar{A} + CB + A\bar{B}C$$
$$= CB + C(\bar{A} + A\bar{B})$$
$$= CB + C(\bar{A} + \bar{B})$$
$$= CB + C\bar{B} + C\bar{A}$$
$$= C(B + \bar{B}) + C\bar{A}$$
$$= C + C\bar{A}$$
$$= \boxed{C}$$

b) $$X = \overline{AB}C + \overline{B + C}$$
$$= (\bar{A} + \bar{B})C + \overline{B + C}$$
$$= (\bar{A} + \bar{B})C + \bar{B}\bar{C}$$
$$= C\bar{A} + C\bar{B} + \bar{C}\bar{B}$$
$$= C\bar{A} + \bar{B}(C + \bar{C})$$
$$\boxed{= C\bar{A} + \bar{B}}$$

c) $$Y = \overline{\overline{AB} + C} + ABC$$
$$= \overline{\overline{AB}}\,\bar{C} + ABC$$
$$= AB\bar{C} + ABC$$
$$\boxed{= AB}$$

d) $$Z = \overline{AC + \bar{B} + C}$$
$$= (\bar{A} + \bar{C})\bar{\bar{B}}\bar{C}$$
$$= (\bar{A} + \bar{C})B\bar{C}$$
$$= B\bar{C}\bar{A} + B\bar{C}\bar{C}$$
$$= B\bar{C}\bar{A} + B\bar{C}$$
$$\boxed{= B\bar{C}}$$

7. ~~Fu~~

a) $F = (\overline{A \oplus C})(\overline{(BD)\,\overline{C}})$

b)

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

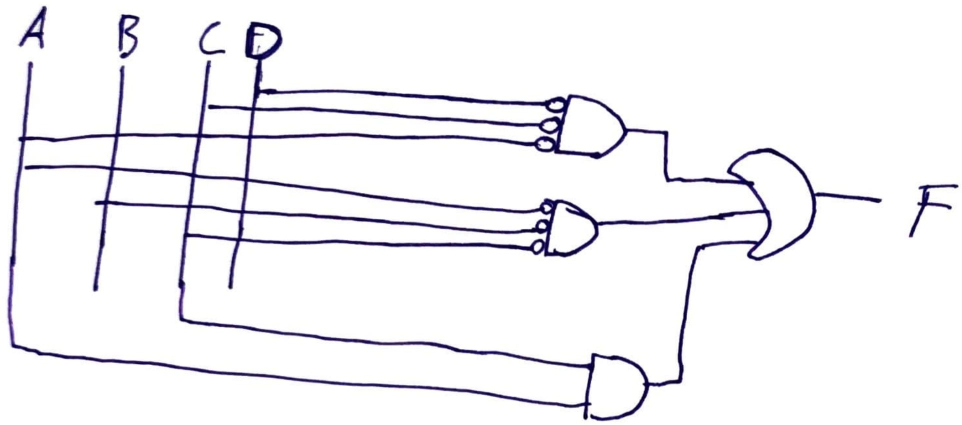
c)

	$\bar{C}\bar{D}$	$\bar{C}D$	CD	$C\bar{D}$
$\bar{A}\bar{B}$	1	1	0	0
$\bar{A}B$	1	0	0	0
AB	0	0	1	1
$A\bar{B}$	0	0	1	1

$\bar{A}\bar{C}\bar{D}$ $\quad \bar{C}\bar{A}\bar{B}$ $\quad AC$

$$\boxed{F = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{C}\bar{D} + AC}$$

d) $F = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{C}\bar{D} + AC$



8\. a) $F = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}B\bar{C}D + A\bar{B}\bar{C}\bar{D} + A\overline{BC}\bar{D}$
$+ A\bar{B}\bar{C}D + AB\bar{C}D + ABCD$

b)

	$\bar{C}\bar{D}$	$\bar{C}D$	CD	$C\bar{D}$
$\bar{A}\bar{B}$	1	1	0	1
$\bar{A}B$	0	1	1	0
AB	1	1	0	0
$A\bar{B}$		1	1	0

$F = \bar{A}\bar{B}\bar{D} + \bar{C}D + \bar{A}BD + AB\bar{C} + A\bar{B}D$

c)