HW1 Solutions

1. (1) $1011_{(2)} = 2^3 + 2^1 + 2^0 = 11_{(10)}$

(2) $1000_{(2)} = 8$

(3) $1111_{(2)} = 15$

(4) $10101.11 = 2^4 + 2^2 + 2^0 + 2^{-1} + 2^{-2}$

$= 21.75_{(10)}$

2. (1) $2 \mid 10$
$2 \mid 5$ 0
$2 \mid 2$ 1
$2 \mid 1$ 0
0 1
$\uparrow$ $1010_{(2)}$

(2) $2 \mid 8$
$2 \mid 4$ 0
$2 \mid 2$ 0
$2 \mid 1$ 0
0 1
$\uparrow$ $1000_{(2)}$

(3) $2 \mid 16$
$2 \mid 8$ 0
$2 \mid 4$ 0
$2 \mid 2$ 0
$2 \mid 1$ 0
0 1
$\uparrow$ $10000_{(2)}$

(4) $2 \mid 52$
$2 \mid 26$ 0
$2 \mid 13$ 0
$2 \mid 6$ 1
$2 \mid 3$ 0
$2 \mid 1$ 1
0 1
$\uparrow$ $110100_{(2)}$

(5) $2 \mid 12$
$2 \mid 6$ 0
$2 \mid 3$ 0
$2 \mid 1$ 1
0 1
$\uparrow$ 1100

$1/2 \mid 0.625$
$1/2 \mid 1.25$ 1
$1/2 \mid 0.5$ 0
0.0 1
$\downarrow$

$1100.101_{(2)}$

3. (a) $100101.101_{(2)}$

$= \underline{00100101}.\underline{1010}$

$= 25.A_{(16)}$

(b) $B1DEC.A_{(16)}$

$= 1101\,1110\,1100.1010_{(2)}$

4. (a) $x(x'+y) = xx' + xy = xy$

(b) $x + xy = x(1+y) = x$

(c) $xy + xy' = x(y+y') = x$

(d) $(A+B)(A+B') = AA + AB' + AB + BB'$

$= A(1+B'+B)$

$= A$

5. (a) $(x+y)(x+z) = xx + xz + xy + yz$

$= x(1+z+y) + yz = x + yz$

(b) $(x+y)(x'+z) =$ ~~$xz + xy$~~

$= xx' + xz + x'y + yz$

$= xz + x'y + (x+x')yz$

$= xz + x'y + xyz + x'yz$

$= xz(1+y) + x'y(1+z)$

$= xz + x'y$

(c) $xy+x'z+yz$

$=xy+x'z+(x+x')yz$

$=xy+x'z+xyz+x'yz$

$=xy(1+z)+x'z(1+y)$

$=xy+x'z$

6. $A\times A=A$ $\quad A\times 0=0$

$A\times 1=A$ $\quad A\times A'=0$

$A+A=A$ $\quad A+0=A$

$A+1=1$ $\quad A+A'=1$

7. $A\times A\times A\times A=A$

$A\times 1\times 0\times B=0$

$((A+A)\times A)+A=A$

$A+1+A+B+0=1$

$(A\times A)+(A+A)=A$

$1+1=1$

$A'+A+A'=1$

$(A'+A)\times A=A$

$A'\times(A+A\times B)0\times 0=0$

~~$1\times 0=0$~~

$1+0=1$

8. (a)

$F=\overline{(\bar{A}+B)\cdot B}\cdot C+B$

$=\overline{(\bar{A}\cdot\bar{B})\cdot B}\cdot C+B$

$=\overline{A\cdot(\bar{B}\cdot B)}\cdot C+B$

$=B$

(b) $G=\overline{\overline{AB}\cdot(B+C)}\cdot C$

$=\overline{(\bar{A}+\bar{B})\cdot(CB+C)}\cdot C$

$=\left(\overline{\bar{A}+\bar{B}}+\overline{B+C}\right)\cdot C$

$=(\bar{\bar{A}}\cdot\bar{\bar{B}}+\bar{B}\cdot\bar{C})\cdot C$

$=ABC$

(c) $H=\overline{(\bar{w}\cdot\bar{x})\cdot(\bar{y}+\bar{z})}$

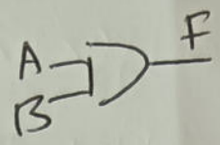
$=\overline{\bar{w}\cdot\bar{x}}+\overline{\bar{y}+\bar{z}}$

$=\bar{\bar{w}}+\bar{\bar{x}}+\bar{\bar{y}}\cdot\bar{\bar{z}}$

$=w+x+yz$

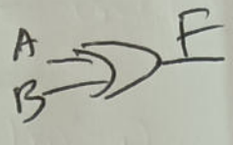
9. AND

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



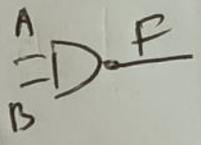
OR

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



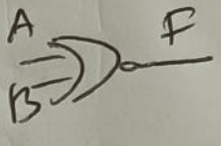
NAND

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



NOR

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

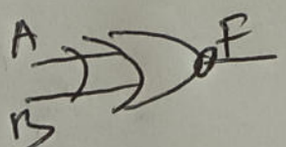


XOR

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

XNOR

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



10. SOP

$F = \bar{x}\bar{y}\bar{z} + \bar{x}y\bar{z} + x\bar{y}z + xyz$

POS:

$F = (x+y+\bar{z}) \cdot (x+\bar{y}+\bar{z}) \cdot (\bar{x}+y+z) \cdot (\bar{x}+\bar{y}+z)$

11. (a) 0 1 0 1 0 1 P

+ 0 0 1 0 1 1 P

0 | 0 0 0 0 0 0 W

overflow

(b) 1 1 0 0 1 0 N

+ 1 0 0 0 0 0 N

1 0 1 0 0 1 0 P

overflow

(c) 1 0 0 1 1 1 N

+ 0 1 0 0 1 0 P

1 1 1 0 0 1 No

overflow

(d) 1 0 1 0 0 N

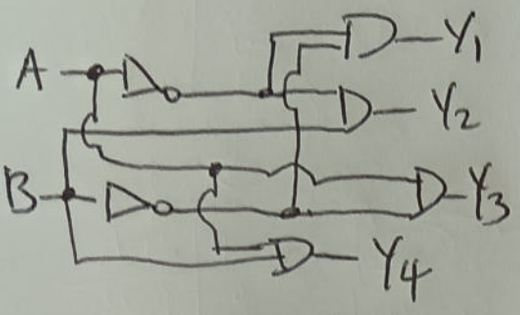
+ 0 1 1 0 1 P

0 0 0 0 0 1 No

overflow

12. $Y_1 = \bar{A}\bar{B}$, $Y_2 = \bar{A}B$

$Y_3 = A\bar{B}$, $Y_4 = AB$



13. $Y_1 = \bar{A}\bar{B} + \bar{A}B = \bar{A}$

$Y_2 = \bar{A}B + AB = B$

$Y_3 = \bar{A}\bar{B} + A\bar{B} = \bar{B}$

$Y_4 = A\bar{B} + AB = A$