Homework #1

Steven Romeiro

Question 1:

a) 100010
111000
001101
(1100111)$_2$

True

$\boxed{(1100111)_2 = (1100111)_2}$

b) 7805
-5274
(2011)$_8$

True

$\boxed{(2011)_8 = (2011)_8}$

c) 1100 | 110011 (100)
-1100
000011

False

$\boxed{(11)_2 \neq (10)_2}$

d) 5E2
x F04
1788
000
583E
585588

True

$\boxed{(585588)_{16} = (585588)_{16}}$

c) Conversion $(1011.101)_2 = (11.5)_8$

001 011 . 101

1 3 . 5 → $(13.5)_8 \neq (11.5)_8$

False

f) Conversion $(1011.1101)_2 = (C.B)_{16}$

1011 . 1101

B . D → $(B.D)_{16} \neq (C.B)_{16}$

False

g) Conversion $(5752.777)_8 = (BEA.1FF)_{16}$

5 7 5 2 . 7 7 7

101 111 101 010 . 111 111 111

1011 1110 1010 . 1111 1111 1000

B E A F F 8

$(BEA.FF8)_8 \neq (BEA.1FF)_8$

False

h) DeMorgan's Law is limited to 2 variables:

False

Question 2:

a) Hex $(1FB)_{16}$ to decimal:

1 F B

0001 1111 1011 $\rightarrow 1+2+8+16+32+64+128+256$

$= \boxed{(207)_{10}}$

b) Octal $(374)_8$ to binary:

3 7 4

011 111 100 $\rightarrow$ $\boxed{(11111100)_2}$

c) Binary $(101111110110)_2$ to Hex:

1011, 1111, 0110

B F 6 $\rightarrow$ $\boxed{(BF6)_{16}}$

d) Decimal $(627)_{10}$ to trinary:

$3\overline{)627} = 209$ R0 $\rightarrow$ $3\overline{)209} = 69$ R2 $\rightarrow$ $3\overline{)69} = 23$ R0

-6 -18 -6

027 29 09

27

$3\overline{)23} = 7$ R2 $\rightarrow$ $3\overline{)7} = 2$ R1 $\rightarrow$ $3\overline{)2} = 0$ R2

-21 -6

2 1

$\boxed{(212020)_3}$

c) What is the base x in $(2400)_x = (1010)_7$

7^3	7^2	7^1	7^0
343	49	7	1

$1 \cdot 343 + 0 \cdot 49 + 1 \cdot 7 + 0 \cdot 1 = (350)_{10}$

5^3	5^2	5^1	5^0
125	25	5	0

$2 \cdot 125 + 4 \cdot 25 + 0 \cdot 5 + 0 \cdot 5 = (350)_5$

X is radix or base 5

Question 3:

a) 8 bits required

b1) 75 - 32 →

+32 = 00100000

-32 = 11100000

$$\begin{array}{rl} 0\,1\,0\,0\,1\,0\,1\,1 & (+75)_{10} \\ +\,1\,1\,1\,0\,0\,0\,0\,0 & (-32)_{10} \\ \hline (0\,0\,1\,0\,1\,0\,1\,1)_2 & (+43)_{10} \end{array}$$

$(00101011)_2$

b2) -57 + 99 →

+57 = 00111001

-57 = 11000111

$$\begin{array}{rl} 1\,1\,0\,0\,0\,1\,1\,1 & (-57)_{10} \\ +\,0\,1\,1\,0\,0\,0\,1\,1 & (+99)_{10} \\ \hline (0\,0\,1\,0\,1\,0\,1\,0)_2 & (+42)_{10} \end{array}$$

$(00101010)_2$

b3) -52 - 84 →

+84 = 01010100

-84 = 10101100

+52 = 00110100

-52 = 11001100

$$\begin{array}{rl} 1\,1\,0\,0\,1\,1\,0\,0 & (-52)_{10} \\ +\,1\,0\,1\,0\,1\,1\,0\,0 & (-84)_{10} \\ \hline 0\,1\,1\,1\,1\,0\,0\,0 & (+120)_{10}\ ? \end{array}$$

$(01111000)_2$ is incorrect due to overflow. We exceeded our available bits

b4) $37+93 \rightarrow$

$$\begin{array}{rr} 0\ 0\ 1\ 0\ 0\ 1\ 0\ 1 & (+37)_{10} \\ +\ 0\ 1\ 0\ 1\ 1\ 1\ 0\ 1 & (+93)_{10} \\ \hline 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0 & (-126)_{10}\ ? \end{array}$$

$(10000010)_2$ is the incorrect answer due to overflow. The sign bit was changed when addition of two positive numbers exceeded the available bits

Question 4:

a) Simplify $XY + XY'$

$X(Y+Y')$

$\boxed{X}$

b) $(X+Y)(X+Y') = X + (Y \cdot Y') = \boxed{X}$ Rule

$A+(BC)=(A+B)(A+C)$

c) $Y'Z + X'YZ + XYZ$

$(YZ)(X+X') + Y'Z$

$(YZ) + Y'Z$

$Z(Y+Y')$

$\boxed{Z}$

d) $(X+Y)(X'+Y+Z)(X'+Y+Z)$ Rule $X \cdot X = X$

$(X+Y)(X'+Y+Z)$ Distributive

$XX' + XY + YX' + XZ + YY + YZ$ Rule $XY + YX' = Y$

$XY + Y + YZ + XZ$ Rule $Y + YZ = Y$

$XY + Y + XZ$ Rule $Y + XY = Y$

$\boxed{Y + XZ}$

e) $X + XYZ + X'YZ + X'Y + WX + WX'$; Rule $XY + XY' = X$

$X + XYZ + X'YZ + X'Y + W$; Rule $XY + XY' = X$

Rule $(XY) + (ZY) = Y(X+Z)$

$X + YZ + X'Y + W$;

$X + Y(Z+X') + W$ distribute

$X + X'Y + YZ + W$ Rule $X + (X'Y) = X + Y$ Elim

$X + Y + YZ + W$ Rule $Y + YZ = Y$ Absorption

$\boxed{X + Y + W}$

Question 5:

A = 10110110

B = 11001000

a) NAND = [(A)(B)]' = [(10110110)(11001000)]'

= (10000000)' = **01111111**

b) NOR = [(A) + (B)]' = [(10110110) + (11001000)]'

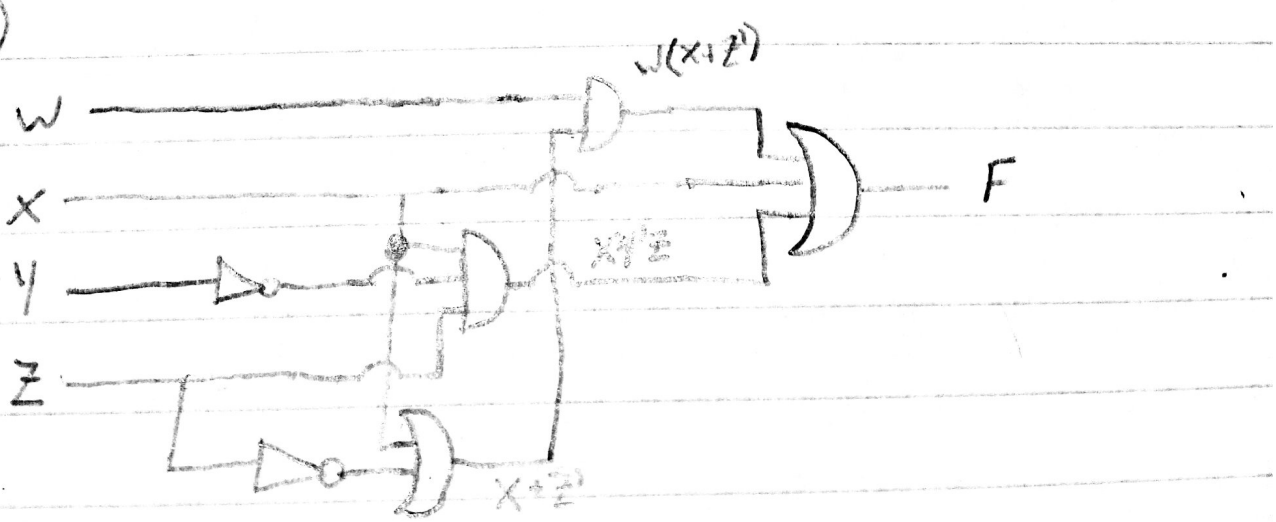
= (01001001)(00110111) = **00000001**

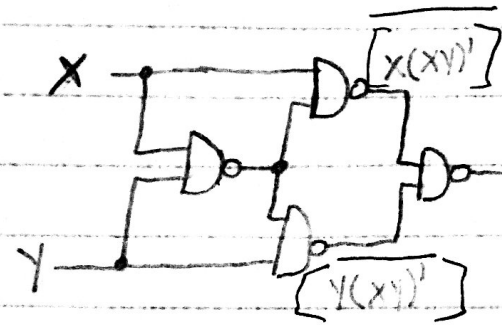
c) XOR = (10110110) ⊕ (11001000)

= **01111110**

Question 6:

a)



b) 

$F = \overline{[\overline{X(XY)'}][\overline{Y(XY)'}]}$

$F \quad \overline{[\overline{X(XY)'}][\overline{Y(XY)'}]} = \overline{\overline{X(XY)'}} + \overline{\overline{Y(XY)'}}$

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

$= XX' + XY' + YX' + YY' = \boxed{XY' + X'Y}$

Question 7:

a) $((A'+B)'(C'+D')')' = (A'+B)'' + (C'+D')''$

$= (A'+B) + (C'+D') = \boxed{A'+B+C'+D'}$

b) $((AB'C)' + (AB')')' = (AB'C)''(AB')''$

$= (AB'C)(AB') = \boxed{AB'C}$

Question 8:

K = Kyle, P = Patrick, J = Jorge, S = Steven

1 = Marshall Center, 0 = Juniper

K	P	J	S	OUTPUT
0	0	0	0	0 → J & S Agree
0	0	0	1	0 → Majority
0	0	1	0	0 → Majority
0	0	1	1	1 → J & S Agree
0	1	0	0	0 → J & S Agree
0	1	0	1	0 → Tie
0	1	1	0	0 → Tie
0	1	1	1	1 → J & S Agree
1	0	0	0	0 → J & S Agree
1	0	0	1	0 → Tie
1	0	1	0	0 → Tie
1	0	1	1	1 → J & S Agree
1	1	0	0	0 → J & S Agree
1	1	0	1	1 → Majority
1	1	1	0	1 → Majority
1	1	1	1	1 → J & S Agree

$K'P'JS + K'PJS + KP'JS + KPJS' + KPJS$

$K'P'JS + K'PJS + KP'JS + KPJ'S + KPJS' + KPJS$

$PJS(K + K') + K'P'JS + KP'JS + KPJ'S + KPJS'$

$PJS + K'P'JS + KP'JS + KPJ'S + KPJS'$

$JS(P + K'P' + KP') + KP(J'S + JS')$

$JS(P + P') + KP(J'S + JS')$

$\boxed{JS + KP(J \oplus S)}$