COMPE 270 HW 1

① Convert the following numbers to hexadecimal + then to binary:

ⓐ 716.67_{10}

$\frac{716}{16} = 44 \text{ r } 12 \rightarrow \frac{44}{16} = 2 \text{ r } 12 \rightarrow \frac{2}{16} = 0 \text{ r } 2$

$\rightarrow 2CC$

$0.67 \times 16 = 10.72 \rightarrow 0.72 \times 16 = 11.52 \rightarrow 0.52 \times 16 = 8.32$

$0.32 \times 16 = 5.12 \rightarrow 0.12 \times 16 = 1.92 \rightarrow 0.92 \times 16 = 14.72 \rightarrow$

$0.72 \times 16 = 11.52 \rightarrow 0.52 \times 16 \rightarrow 0.\overline{AB851E}$

$2CC.\overline{AB851E}$ * $001011001100.\overline{101010111000010100011110}$

ⓑ 66.17_{10}

$\frac{66}{16} = 4 \text{ r } 2 \rightarrow \frac{4}{16} = 0 \text{ r } 4 \rightarrow 42_{16}$

$0.17 \times 16 = 2.72 \rightarrow 0.72 \times 16 = 11.52 \rightarrow 0.52 \times 16 = 8.32$

$0.32 \times 16 = 5.12 \rightarrow 0.12 \times 16 = 1.92 \rightarrow 0.92 \times 16 = 14.72$

$\rightarrow 2B851E$

$\rightarrow 42.\overline{2B851E}_{16}$ * $01000010.\overline{001010111000010100011110}$

ⓒ 28.35_{10}

$\frac{28}{16} = 1 \text{ r } 12 \rightarrow \frac{1}{16} = 0 \text{ r } 1 \rightarrow 1C$

$0.35 \times 16 = 5.6 \rightarrow 0.6 \times 16 = 9.6 \rightarrow 0.6 \times 16 = 9.6 \} 59$

$1C.5\overline{9}_{16}$ * $00011100.0101\overline{1001}_2$

ⓓ 12.81

$12 = C \rightarrow .81 \times 16 = 12.96 \rightarrow 0.96 \times 16 = 15.36 \rightarrow 0.36 \times 16 = 5.76$

$0.76 \times 16 = 12.16 \rightarrow 0.16 \times 16 = 2.56 \rightarrow 0.56 \times 16 = 8.96$

$\rightarrow C.C\overline{F5C28}_{16}$ * $1100.1100\overline{11110101110000101000}_2$

Compe 270 HW Cont.

② Add, subtract, * multiply in binary

(a) 1111 + 1010

```
  1111        1111         1111
+ 1010      - 1010       x 1010
------      ------       ------
 11001₂      0101₂         0000
                          11110
                         000000
                        1111000
                       --------
                       10010110₂
```

(b) 110110 * 11101

```
  110110       110110         110110
+  11101     -  11101        x 11101
--------     --------       --------
 1010011₂      11001₂         110110
                             0000000
                            11011000
                           110110000
                          1101100000
                         -----------
                         11000011110₂
```

(c) 100100 * 10110

```
  100100       100100         100100
+  10110     -  10110        x 10110
--------     --------       --------
  111010₂       01110₂        000000
                             1001000
                            10010000
                           000000000
                          1001000000
                         -----------
                          1100011000₂
```

3 (a) Assume the integers below are in 1s complement form. Find the decimal values of these numbers

(i) 0000000 $= 0_{10}$

(ii) 1111111
flip bits
$0000000_2 = 0_{10}$

(iii) 0110011 $= 2^0_{10} + 2^1_{10} + 2^4_{10} + 2^5_{10} = 51_{10}$

(iv) 1000000_2
flip bits $\Rightarrow 0111111_2$ $15 + 2^4 + 2^5 = 15 + 16 + 32 = -63_{10}$

COMPE 270 HW 1 CONT.

(b) Repeat 3(a), assuming the binary numbers are in 2s complement form

(i) $0000000_2 = 0_{10}$

(ii) 1111111_2
flip bits
$\Rightarrow 0000000_2$
add one $= -1_{10}$

(iii) 0110011_2
$= 51_{10}$

(iv) 1000000
flip bits $= 0111111$
add one $= 1000000$
$= -64_{10}$

(c) Find the binary 2s complement representation of the following decimal values

(i) 28_{10}
$\boxed{= 011100_2}$
$2^4 + 2^3 + 2^2 = 28$

(ii) -7_{10}
$7 = 0111$
flip bits $\Rightarrow 1000$
add one $= 1001$
$\boxed{= 1001_2}$

(iii) -42_{10}
$42 = 0101010_2$
flip bits $\Rightarrow 1010101_2$
add one $\Rightarrow 1010110_2$
$\boxed{= 1010110_2}$

(iv) -15_{10}
$15 = 01111_2$
flip bits $\Rightarrow 10000_2$
add one
$\boxed{= 10001_2}$

(4) Prove the following theorems using truth table

(a) $X + XY = X$

X	Y	XY	X + XY
0	0	0	0
0	1	0	0
1	0	0	1
1	1	1	1

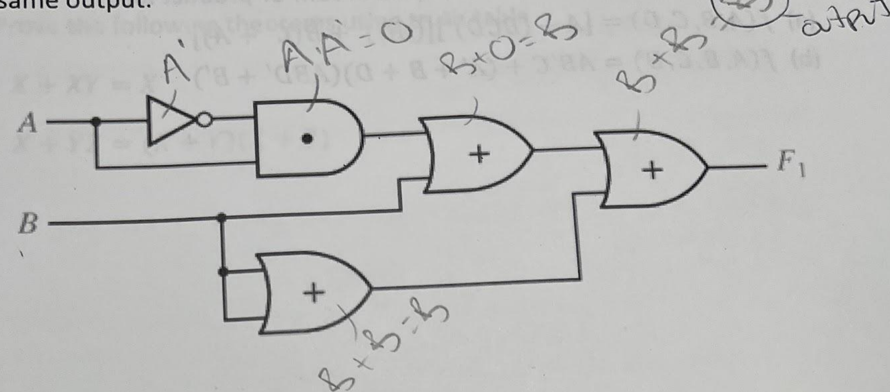
SAME OUTCOMES, SO THUS $X = X + XY$

(b) $X + YZ = (X+Y)(X+Z)$

X	Y	Z	YZ	X+Y	X+Z	(X+Y)(X+Z)	X+YZ
0	0	0	0	0	0	0	0
0	0	1	0	0	1	0	0
0	1	0	0	1	0	0	0
0	1	1	1	1	1	1	1
1	0	0	0	1	1	1	1
1	0	1	0	1	1	1	1
1	1	0	0	1	1	1	1
1	1	1	1	1	1	1	1

SAME ANSWER, THUS $(X+Y)(X+Z) = X + YZ$

5. For the circuit below, find the output and design a simpler circuit that has the same output.



B — F_1

(6) Use DeMorgan's law + Involution law to find the complement of the following functions. Express the results in sum of product form.

(a) $f(a,b,c,d) = [A+(BCD)'][(AD)' + B(C'+A)]$

$([A+(BCD)'][(AD)'+B(C'+A)])'$

$\rightarrow ([A+(BCD)'])' + ([(AD)'+B(C'+A)])'$

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

$\rightarrow (A'(BCD)) + (AD(B'+(C'+A)')) \rightarrow (A'(BCD)) + (AD(B'+CA'))$

$\rightarrow A'BCD + AB'D + \cancel{ACDA'} \rightarrow 0$

$\boxed{= A'BCD + AB'D}$

(b) $f(A,B,C,D) = AB'C + (A'+B+D)(ABD'+B')$

$(AB'C + (A'+B+D)(ABD'+B'))'$

$\rightarrow ((AB'C)'((A'+B+D)(ABD'+B'))')$

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

$\rightarrow ((A'+B+C')((AB'D')+((ABD')'B)))$

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

$\rightarrow (A'+B+C')((AB'D')+(A'B+\cancel{B'B} \rightarrow 0 + BD))$

$\rightarrow \cancel{A'AB'D'} \rightarrow 0 + A'A'B + A'BD + \cancel{BAB'D'} \rightarrow 0 + BA'B + BBD + C'AB'D' + C'A'B + C'BD$

$\rightarrow A'B + A'BD + A'B + BD + AB'C'D' + A'BC' + BC'D$

$\rightarrow = \boxed{A'B + BD + AB'C'D' + BC'D' + A'BC'}$