HW1 (208 points in total)

1. Convert the following binary numbers to decimal: (20 points)

   (1) 1011
   (2) 1000
   (3) 1111
   (4) 10101.11

2. Convert the following decimal numbers to binary: (20 points)

   (1) 10
   (2) 8
   (3) 16
   (4) 52
   (5) 12.625

3. (a) Convert to hexadecimal: 100101.101_2. (10 points)

(b) Convert to binary: DEC.$A_{16.}$

4. Prove the following theorems algebraically: (20 points)

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

(b) $X+XY=X$

(c) $XY+XY'=X$

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

5. Prove the law/theorem is being used: (15 points)

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

(b) $(X+Y)(X'+Z)=XZ+X'Y$

(c) $XY+X'Z+YZ=XY+X'Z$

6. Complete the following logic expressions: (8 points)

AxA= Ax0= Ax1= AxA'=

A+A= A+0= A+1= A+A'=

7. Complete the following logic expressions: (10 points)

A x A x A x A =

A x 1 x 0 x B =

((A + A) x A) + A =

A + 1 + A + B + 0 =

(A x A) + (A + A) =

1 + 1 =

A' + A + A' =

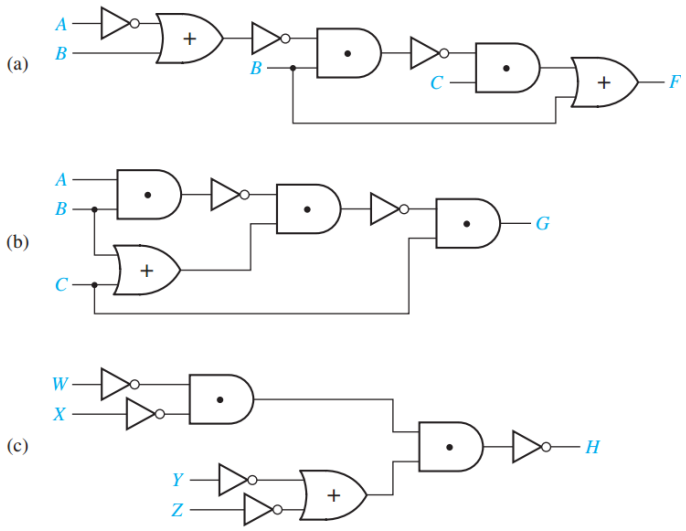
(A' + A) x A =

HW1 (208 points in total)

A’ x (A + A x B) 0 x 0 =

1 + 0 =

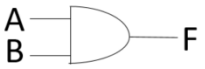
8. Find logic expressions of F, G, H and simplify: (15 points)



9. Summarize the truth table for the following logic gates: (draw the truth table, inputs: A, B, output: F, also draw their gate symbols). (30 points)

AND, OR, NAND, NOR, XOR, XNOR

**Example: AND



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

10. Provide the SOP and POS, and the equivalent logic gate circuitry of those expressions for the truth table: (20 points)

HW1 (208 points in total)

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

11. Add the following numbers in binary using 2's complement to represent negative numbers. Indicate if an overflow occurs. (20 points)

(a) In a 6-bit computer system, 21+11

(b) In a 6-bit computer system, (-14)+(-32)

(c) In a 6-bit computer system, (-25)+18

(d) In a 5-bit computer system, (-12)+13

12. Design a regular 2-4 decoder from the following truth table. Draw the gate level digital circuit from the design. (10 points)

A	B	Y1	Y2	Y3	Y4
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

13. Design a decoder circuit from the following truth table. (10 points)

A	B	Y1	Y2	Y3	Y4
0	0	1	0	1	0
0	1	1	1	0	0
1	0	0	0	1	1
1	1	0	1	0	1