CS3810 Homework 5

3.6

> Assume 185 and 122 are unsigned 8-bit decimal integers. Calculate 185-122. Is there overflow, underflow, or neither?

```
    185          1011 1001
-   122     -    0111 1010
--------  -----------------
    063          0011 1111
```

Answer: 063(ten) 0011 1111(binary). With underflow.

3.17

> As Discussed in the text, one possible performance enhancement is to do a shift and add instead of an actual multiplication. Since 9 X 6, for example, can be written (2 x 2 x 2 + 1) x 6, we can calculate 9 x 6 by shifting 6 to the left 3 times and then adding 6 to that result. Show the best way tocalculate 0 x 33 x 0 x 55 using shifts and adds/subtracts. Assume both inputs are 8-bit unsigned integers

0x33 = 51(ten) 0x55 = 85(ten)

51x85 can be written (2x2x2x2x2x2+21)x51

51*64 = 1100 1100 0000 (by shifting 51 to the left 6 times) 51*21 = 0100 0010 1111

```
    1100 1100 0000
+   0100 0010 1111
------------------
    1 0000 1110 1111    4335(ten)
```

Answer: 1 0000 1110 1111(binary), 4335(ten)

3.23

> Write down the binary representation of the decimal number 63.25 assuming the IEEE 754 single precision format.

63.25 = 253 x 2-2 = 1.1111101 x 25

0 10000100 11111010000000000000000

Answer: 0 10000100 11111010000000000000000

3.24

> Write down the binary representation of the decimal number 63.25 assuming the IEEE 754 double precision format

Answer: 0 10000000100 1111101000000000000000000000000000000000000000000000

B.1

> In addition to the basic laws we discussed in this section, there are two important theorems, called DeMorgan's theorems:
>
> $\overline{A+B} = \overline{A} \cdot \overline{B}$ and $\overline{A \cdot B} = \overline{A} + \overline{B}$
>
> Prove DeMorgan's theorems with a truth table of the form

A	B	$\overline{A}$	$\overline{B}$	$\overline{A+B}$	$\overline{A} \cdot \overline{B}$	$\overline{A \cdot B}$	$\overline{A} + \overline{B}$
0	0	1	1	1	1	1	1
0	1	1	0	0	0	1	1
1	0	0	1	0	0	1	1
1	1	0	0	0	0	0	0

Answer: The columns $\overline{A+B}$ and $\overline{A} \cdot \overline{B}$. So are the columns $\overline{A \cdot B}$ and $\overline{A} + \overline{B}$

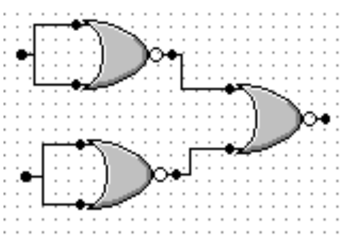
A	B	$\overline{A+B}$	$\overline{A}\cdot\overline{B}$	$\overline{A\cdot B}$	$\overline{A}+\overline{B}$
0	0	1	1	1	1
0	1	1	0	0	0
1	0	0	1	0	0
1	1	0	0	0	0

B.5

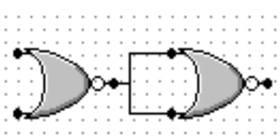
> Prove that the NOR gate is universal by showing how to build the AND, OR, and NOT functions using a two-input NOT gate

Answer:

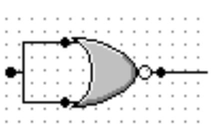
AND



OR



NOT



B.15

> Derive the product-of-sums representation for E shown on page B-11 starting with the sum-of-products representation. You will need to use DeMorgan's theorems.

Answer:

Derive E = ((A' + B'+ C) * (A' + C' + B) * (B' + C' + A))'

Sum of Products

E = (ABC') + (ACB')+(BCA')

E' = ((ABC') + (ACB') +(BCA'))'

E' = ((ABC')'(ACB')'(BCA')'

E' = (A'+B'+C)(A'+C'+B)(B'+C'+A)

Product of Sums = E = ((A'+B'+C)(A'+C'+B)(B'+C'+A))'

B.17

> Show a truth table for a multiplexer (inputs A, B, and S; output C), using don't cares to simplify the table where possible

Answer:

A	B	S	C
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1