CSCI 230
Fall 2014
Test #2
100 points

Name: _____

1. (14 pts) Assuming that we are doing 32-bit integer computations, what is the hexadecimal value of each of the following C expressions?

   a. `0x3 & 0x9`
      `0011 & 1001 = 0001 = 0x1`

   b. `0x3 | 0x9`
      `0011 | 1001 = 1011 = 0xB`

   c. `0x3 ^ 0x9`
      `0011 ^ 1001 = 1010 = 0xA`

   d. `0xAF | 0x5E`
      `10101111 | 01011110 = 11111111 = 0xFF`

   e. `0xAF & 0x5E`
      `10101111 & 01011110 = 00001110 = 0x0E`

   f. `0xAF ^ 0x5E`
      `10101111 ^ 01011110 = 11110001 = 0xF1`

   g. `0xAF << 3`
      `10101111000 = 0x578`

2. (12 pts) Consider the following C function:

   a. What does `f(2, 5)` return?
      `5`

   b. What about `f(10, 2)`?
      `20`

   c. What about `f(10, 6)`?
      `21`

   d. What about `f(f(2, 10), 7)`?
      `13`

```
int f(int x, int n) {
    return (x << 1) ^ (n >> 2);
}
```

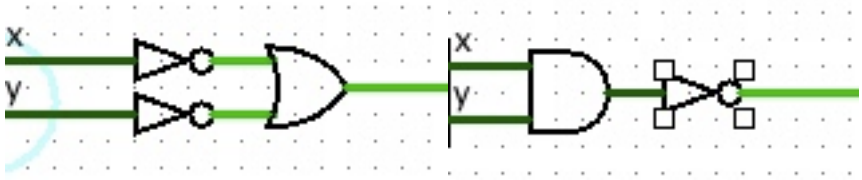
3. (8 pts) Using only bit operators, complete the C function below. It should return the second highest byte in its 32 bit parameter. For example, given the parameter 0x7F2A34C2, it should return 0x2A.

```
int second_highest_byte(int bits) {


     return (bits >> 16) & 0xFF;
}
```

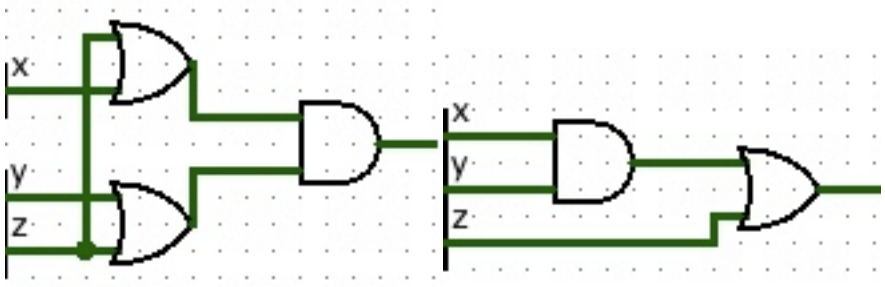
4. (12 pts) For each circuit below, create a truth table for the circuit, and redraw it to use two gates instead of three:

a.



x	y	out
1	1	0
1	0	1
0	1	1
0	0	1

b.

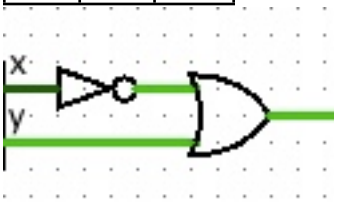


x	y	z	out
1	1	1	1

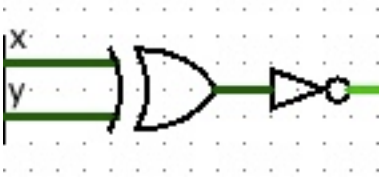
x	y	z	out
1	1	0	1
1	0	1	1
1	0	0	0
0	1	1	1
0	1	0	0
0	0	1	1
0	0	0	0

5. (12 pts) For each truth table, draw a corresponding circuit:

x	y	out
1	1	1
1	0	0
0	1	1
0	0	1

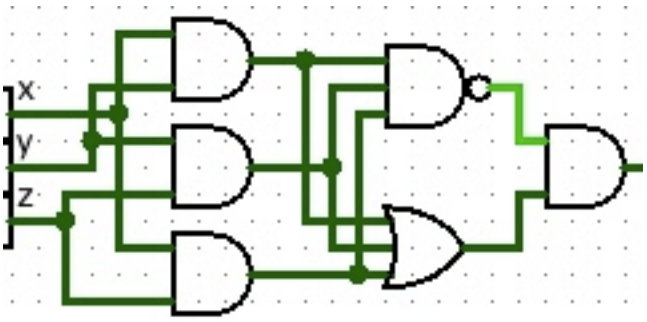


x	y	out
1	1	1
1	0	0
0	1	0
0	0	1

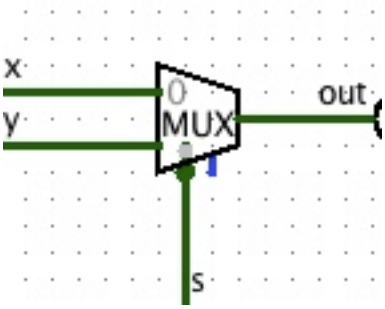


x	y	z	out
1	1	1	0
1	1	0	1
1	0	1	1
1	0	0	0
0	1	1	1
0	1	0	0

x	y	z	out
0	0	1	0
0	0	0	0

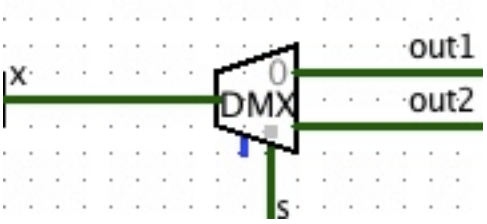


6. (8 pts) Draw a truth table for a 2-to-1 multiplexer.



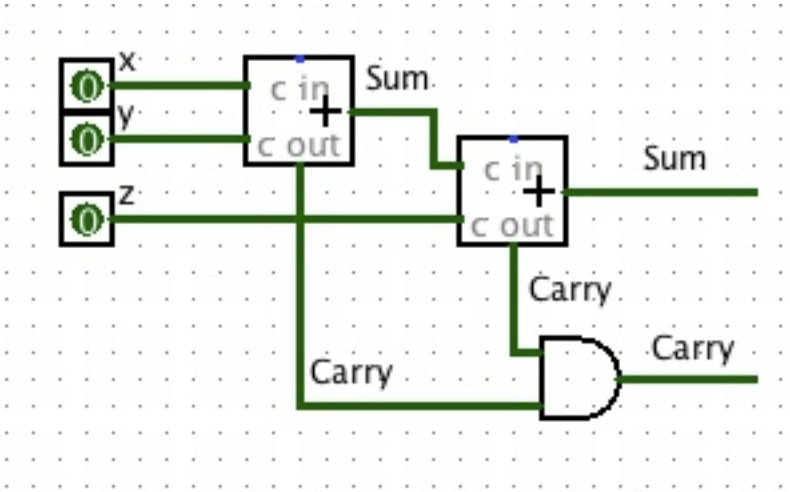
x	y	s	out
?	1	1	1
?	0	1	0
1	?	0	1
0	?	0	0

7. (8 pts) Draw a truth table for a 1-to-2 demultiplexer.

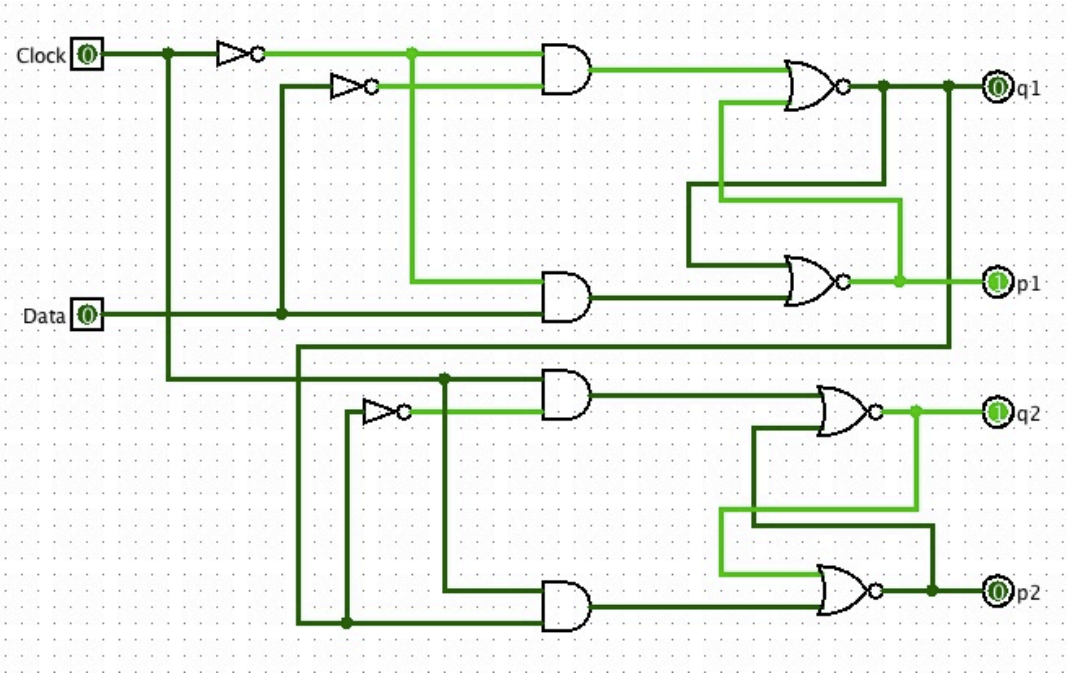


x	s	out1	out2
1	1	0	1
1	0	1	0
0	?	0	0

8. (10 pts) Using only half-adders, diagram how you could construct a full adder. Be sure to label your inputs *x*, *y*, and *z* and the outputs *carry* and *sum*. Also, please label the outputs *carry* and *sum* for each half-adder.

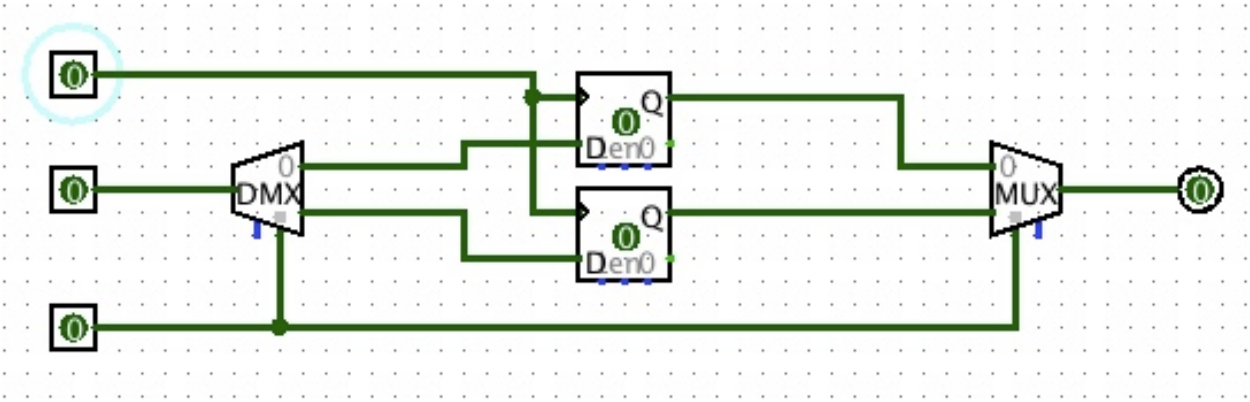


9. (8 pts) Examine the circuit below. Then fill in the truth table. Assume each row in the truth table happens sequentially after the previous row.



Clock	Data	q1	p1	q2	p2
0	0	0	1	1	0
1	0	0	1	0	1
0	0	0	1	0	1
0	1	1	0	0	1
1	1	1	0	1	0
0	1	1	0	1	0
0	0	0	1	1	0

10. (8 pts) Examine the circuit below. One of the inputs is the “data”, another is the “select”, and another is the “clock”. Fill in the correct label for each input. Then complete the truth table below. Assume each row in the truth table happens sequentially after the previous row.



Data	Select	Clock	Output	Top Flip-Flop	Bottom Flip-Flop
0	0	0	0	0	0
1	0	0	0	0	0
1	0	1	1	1	0
1	0	0	1	1	0
1	1	0	0	1	0
1	1	1	1	0	1