CSE260 Exam I

Name: _____

ID Number: _____

- This exam is open book and open notes. You may only use materials that you brought with you. You may not use someone else's notes.
- If the question requires you to provide code, you must use correct syntax and semantics to receive full credit. We should be able to type your answer into Eclipse and verify that it works.
- This exam is worth 15% of your final grade.
- The exam is broken up into 7 questions and is worth 100 points. It is your responsibility to make sure you have all of the pages.

Section	Possible Points	TA Initials	Score
I	10		
II	15		
III	16		
IV	12		
V	12		
VI	15		
VII	20		

Pledge: On my honor, I have neither given nor received any unauthorized aid on this exam.

Signed: _____

1. (10 points) Convert the following decimal numbers to both hexadecimal and binary:

a.) 99

1100011

63

b.) 671

1010011111

29F

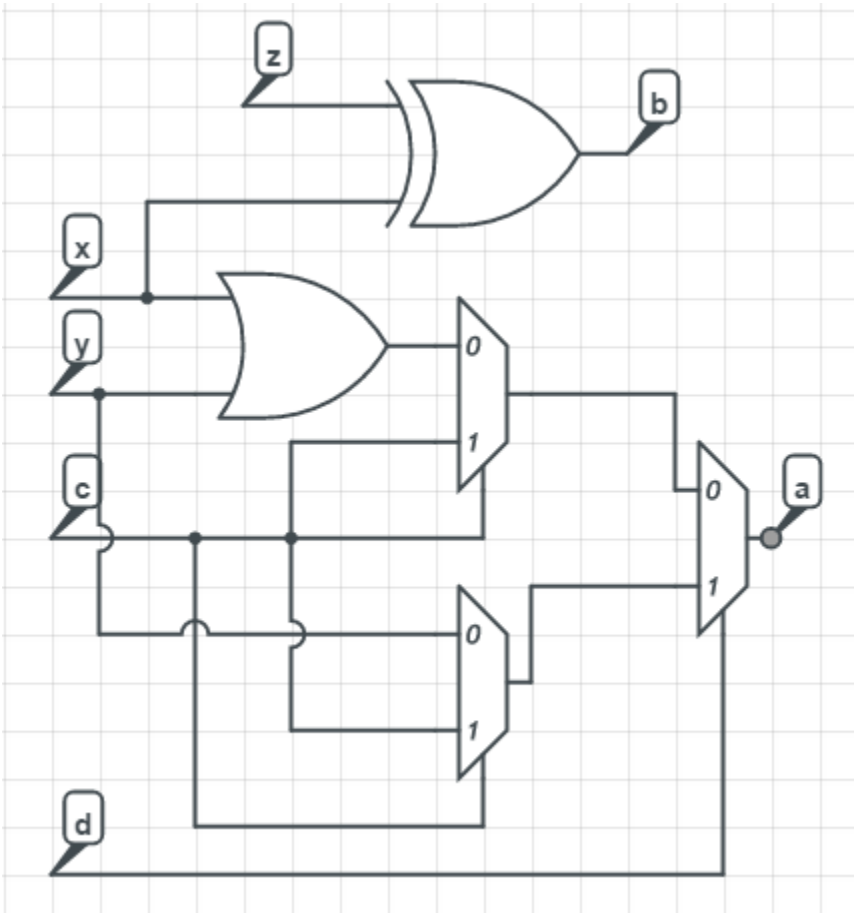
c.) 2015

11111011111

7DF

2. (15 points) Construct a logic circuit for the following VHDL code segment:

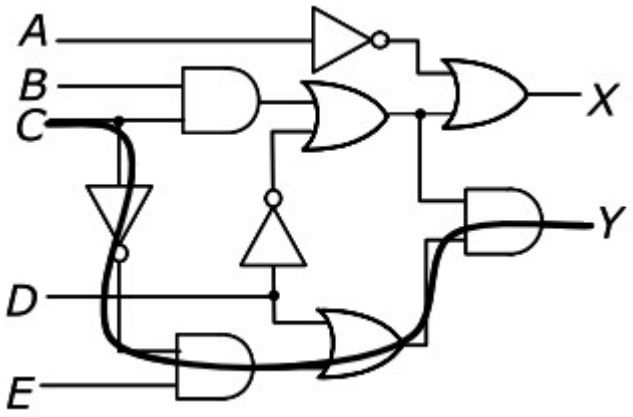
```
b <= x xor z;
a <= x or y when c or d = '0' else
     y when d > c else
     c
```



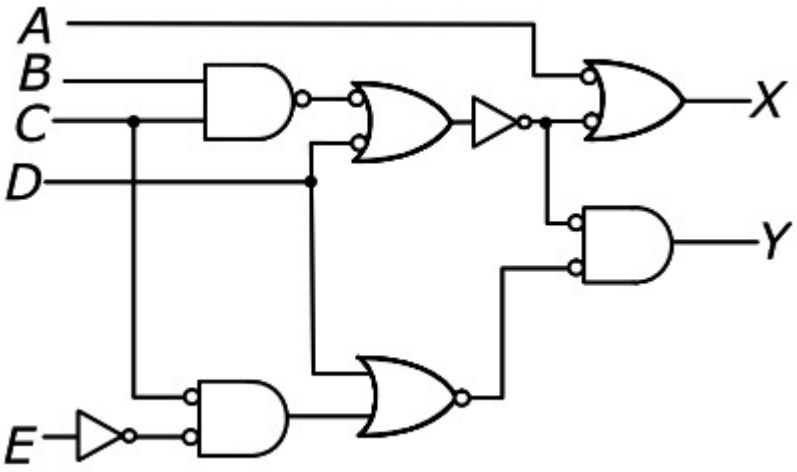
3. (16 points). Using as few gates as possible, construct a circuit for the following equations using only AND, OR and NOT:

$$(C'E + D)(BC + D') = Y$$

$$A' + (BC + D') = X$$



Now redraw your circuit using only NAND, NOR, and NOT such that it uses <u>fewer transistors</u> than your original circuit. State how many transistors are in each circuit.



4. (12 points) Simplify the following expression using boolean algebra, showing each step. Leave your answer in sum of products form.

$$A'B + (A + B')C + (A + C)'B$$

$$A'B + AC + B'C + A'BC'$$

$$A'B + AC + B'C$$

$$A'B + (A + B')C$$

$$A'B + (A'B)'C$$

$$A'B + C$$

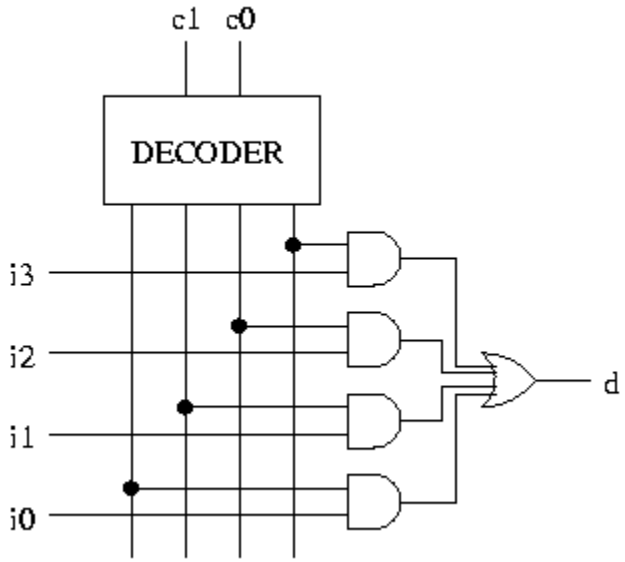
5. (12 points) Use a K-map to simplify the following expression. Leave your answer in sum of products form.

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

AB\CD	00	01	11	10
00		1	1	
01	1	1		
11	1			1
10		1	1	

$$B'D + ABD' + A'BC'$$

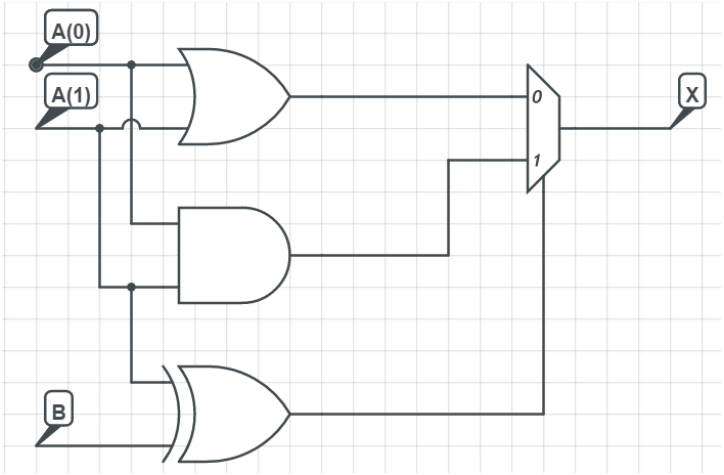
6. (15 points) Construct a 4 input mux using a 2 to 4 decoder. You may use any logic gates you wish, but you must use at least one 2 to 4 decoder.



How many transistors are in your circuit?

There are 62 transistors in the above circuit, 28 of which come from the decoder.

7. (20 points) Write VHDL for the following circuit. You must include the entity definition as well as the behavioral code.




```
entity foo is port (
    A: in std_logic_vector(1 downto 0);
    B: in std_logic;
    X: out std_logic;
    );
end foo;

architecture a1 of foo is
begin
    X <= A(0) or A(1) when b xor a(1) else
        A(0) and A(1);
end a1;
```