

1. (15 points) Answer the following questions.

(a) Describe the difference between a bit and a byte.

(b) Describe the difference between an **OR** gate and a **XOR** gate.

(c) How many things can be represented by 3 bits?

(d) What are **all** the digits in the octal (base 8) number system?

(e) What is circuit equivalence?

2. Consider the base 10 number 155.
 - (a) (5 points) Convert 155 to binary.
 - (b) (5 points) Convert 155 to hexadecimal.

3. Let $A = 242$ be a **base 7** number and $B = 421$ be a **base 5** number.
- (a) (5 points) Determine the base 10 representation of A .
 - (b) (5 points) Determine the base 10 representation of B .
 - (c) (5 points) Determine the base 10 representation of $A + B$.

4. Let $A = 010100011$ and $B = 01101101$ be binary numbers.
- (a) (5 points) Find $A + B$ using binary addition.
 - (b) (5 points) Find $A - B$ using binary subtraction.
 - (c) (5 points) Assuming you are using 8 binary digits to represent positive and negative numbers, use the two's complement to determine $-B$.

5. (10 points) Convert the decimal (base 10) number $\frac{24}{5}$ to binary (base 2).

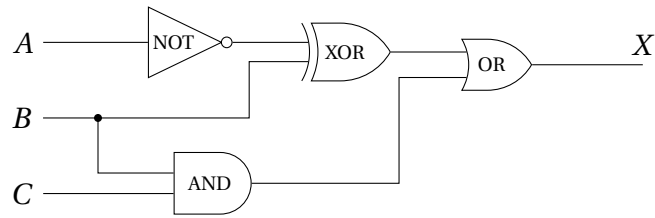
6. Consider the Boolean expression $X = [(A + B)' \oplus (A \cdot C)] + C$.

(a) (5 points) Draw a circuit diagram for X .

(b) (5 points) Complete the following truth table to find all possible truth values of X .

A	B	C	$A + B$	$(A + B)'$	$A \cdot C$	$(A + B)' \oplus (A \cdot C)$	$[(A + B)' \oplus (A \cdot C)] + C$
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					

7. Consider the following circuit.



(a) (5 points) Write the Boolean expression for X .

(b) (5 points) Make a truth table that determines all possible values for X .

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

8. (10 points (bonus)) Draw a circuit for the boolean expression $X = [(A' \cdot B') \oplus C] + (C \oplus D)'$ and determine the value of X if $A, B, C,$ and D all start with a 1 signal.