

1. (15 points) Answer the following questions.

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

(b) Describe the difference between an **AND** gate and a **NAND** gate.

(c) What are the three terminals in a transistor?

(d) What are **all** the digits in the Hexadecimal (base 16) number system?

(e) What is the radix point?

2. Let $A = 143$ and $B = 73$.
- (a) (5 points) Convert A and B to binary.
 - (b) (5 points) Convert A and B to octal (base 8).
 - (c) (5 points) Convert A and B to hexadecimal (base 16).

3. Let $A = 10100011$ and $B = 1101101$ be binary numbers.
- (a) (5 points) Find $A + B$ using binary addition.
 - (b) (5 points) Find $A - B$ using binary subtraction.
 - (c) (5 points) Use the two's complement to find $-B$.

4. (10 points) Convert the decimal (base 10) number $\frac{73}{9}$ to binary (base 2).

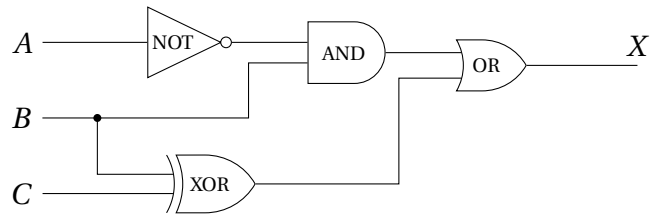
5. Consider the Boolean expression $X = [(A + B)' \cdot (A \cdot C)] \oplus C$.

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

6. 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				

7. Consider the number 2016.

- (a) (5 points) If 2016 is a base 7 number, what is its value in base 10?
- (b) (5 points) If 2016 is a base 9 number, what is its value in base 10?

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