## Cpt S 260 Introduction to Computer Architecture

## **Homework 1 - Answers**

Represent the following boolean expressions in terms of logic gates and truth tables. For problem 1, use NAND gates only. For problem 2, use NOR gates only

1. ( (AB)' + (BC)' )'

Answer:



Truthtable:

Α	В	С	(AB)'	(BC)'	((AB)'+(BC)')'
0	0	0	1	1	0
0	0	1	1	1	0
0	1	0	1	1	0
0	1	1	1	1	0
1	0	0	1	1	0
1	0	1	1	1	0
1	1	0	0	1	0
1	1	1	0	0	1

2. A ( BC + C' )

Answer:



Truthtable:

Α	B	С	BC	BC+C'	A(BC+C')
0	0	0	0	1	0
0	0	1	0	0	0
0	1	0	0	1	0
0	1	1	1	1	0
1	0	0	0	1	1
1	0	1	0	0	0
1	1	0	0	1	1
1	1	1	1	1	1

Convert the following logic circuits into boolean expressions of AND, OR, NOT operations only and write the truthtable for the same

3.



Answer:

 $(\ A'B' + AB\ )\ C + (\ A'B' + AB\ )'\ C' \\ or\ (A'B'C' + ABC' + (A+B)\ (A'+B')\ C \\$ 

or (A'B'C' + ABC' + A'BC + AB'C)

Truthtable:

A	B	С	A XOR B	C'	(A XOR B) XOR C'
0	0	0	0	1	1
0	0	1	0	0	0
0	1	0	1	1	0
0	1	1	1	0	1
1	0	0	1	1	0
1	0	1	1	0	1
1	1	0	0	1	1
1	1	1	0	0	0

4.



Answer: ((AB)(B' + C))' or(AB)' + (BC')or A' + B' + BC'

Truthtable:

Α	B	С	AB	( <b>B'</b> + <b>C</b> )	[ (AB) (B'+C) ]'
0	0	0	0	1	1
0	0	1	0	1	1
0	1	0	0	0	1

0	1	1	0	1	1
1	0	0	0	1	1
1	0	1	0	1	1
1	1	0	1	0	1
1	1	1	1	1	0

## General tips and suggestions

- Try to use formats for the truthtables similar to what has been used above. You are free to use 'T' or 'F' instead of '1' and '0' and to write the combinations in any order. But it would be easy if you separate the columns and label them clearly. For example if the truth table result is (A' + B'), it would be clear if you make separate columns for A', B' and (A' + B'). It is optional to leave out A' and B' columns. You could directly write the result too.
- 2. Do not make repetitions in the combinations for the inputs in the truth table. For example, "T F F" and again "T F F" and you will not be able to spot some other missing combination. Please make sure that all the possible combinations are there in the truthtable. One way to ensure you don't miss out anything would be to follow a binary sequence of combinations as shown above.
- 3. Please draw the gates clearly. They need not be well drawn. Rather make sure that it is easy to distinguish clearly between the ANDs and ORs and NANDs and NORs. In some papers, the AND and OR gate looked too similar.