CPE201 HW 4 (100 points)

Answer all questions completely. Put a box around the final solution. Put your name on it. Show your work.

By hand:

1. Create a truth table for the following expressions:
   a. AB'C + A'B

A	B	C	B'	AB'C	A'	A'B	Output
0	0	0	1	0	1	0	0
0	0	1	1	0	1	0	0
0	1	0	0	0	1	1	1
0	1	1	0	0	1	1	1
1	0	0	1	0	0	0	0
1	0	1	1	1	0	0	1
1	1	0	0	0	0	0	0
1	1	1	0	0	0	0	0

   b. (A + BC')(A' + C)

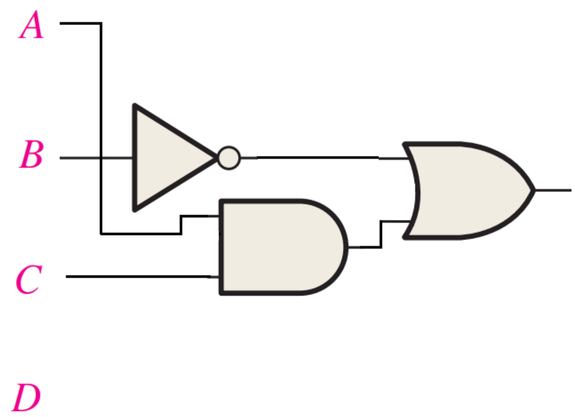
A	B	C	C'	BC'	A+BC'	A'	A'+C	Output
0	0	0	1	0	0	1	1	0
0	0	1	0	0	0	1	1	0
0	1	0	1	1	1	1	1	1
0	1	1	0	0	0	1	1	0
1	0	0	1	0	1	0	0	0
1	0	1	0	0	1	0	1	1
1	1	0	1	1	1	0	0	0
1	1	1	0	0	1	0	1	1

   c. (A + B)'C'

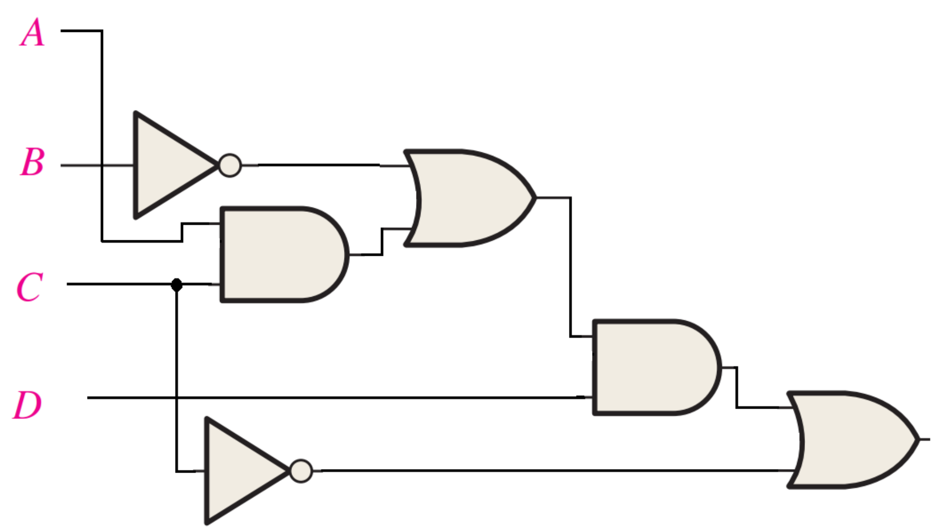
A	B	C	A+B	(A+B)'	C'	Output
0	0	0	0	1	1	1
0	0	1	0	1	0	0
0	1	0	1	0	1	0
0	1	1	1	0	0	0
1	0	0	1	0	1	0
1	0	1	1	0	0	0
1	1	0	1	0	1	0
1	1	1	1	0	0	0

2. Draw the logic circuit represented by the following expressions:
    a. A + B(C’ + D(B’ + AC))

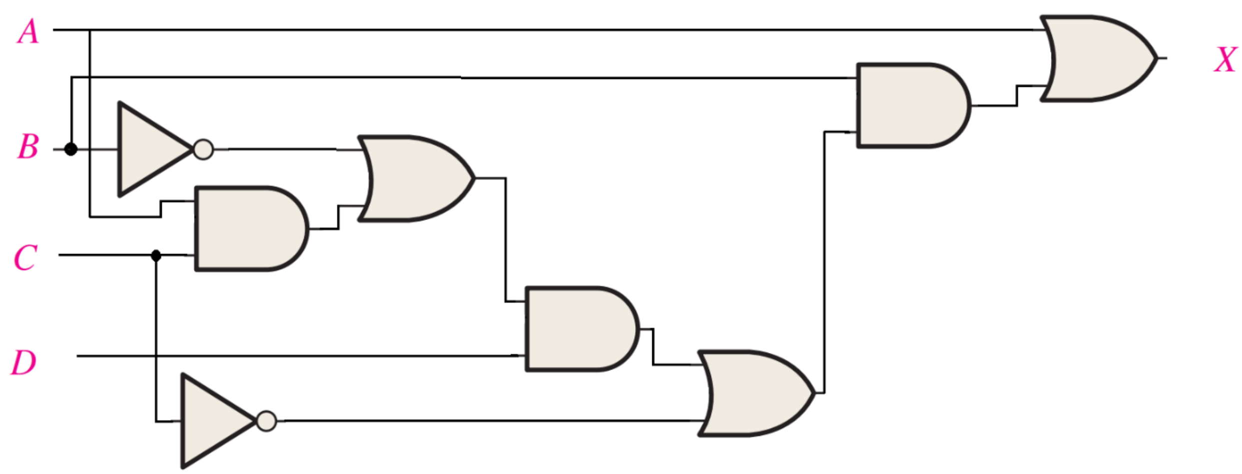
Start at the inside most parentheses to create B’+AC



Now add the circuitry for the next parenthesis out to create C’ + D(B’ + AC)

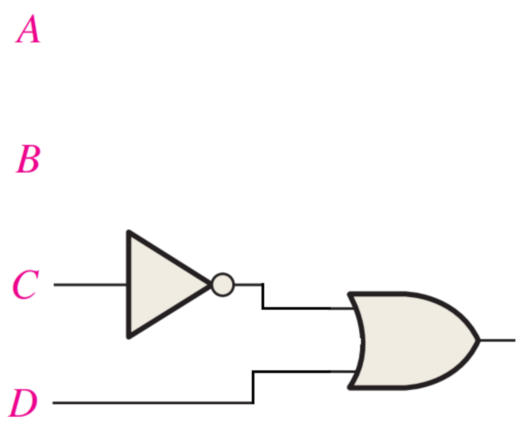


Add the remaining logic to get the complete circuit

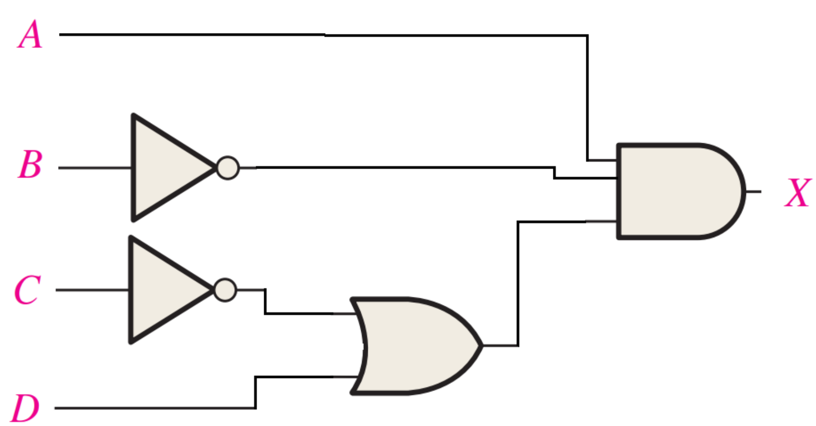


b. AB’(C’ + D)

Starting from the inside of the expression, for C’+D:



Now creating the AND of the other pieces gives the final circuit



3. Convert the following expression to SOP form: A + B(C’ + D(B’ + AC))

Create the truth table for the expression

A	B	C	D	AC	B’	B’+AC	D(B’+AC)	C’	C’ + D(B’ + AC)	B(C’ + D(B’ + AC))	Output
0	0	0	0	0	1	1	0	1	1	0	0
0	0	0	1	0	1	1	1	1	1	0	0
0	0	1	0	0	1	1	0	0	0	0	0
0	0	1	1	0	1	1	1	0	1	0	0
0	1	0	0	0	0	0	0	1	1	1	1
0	1	0	1	0	0	0	0	1	1	1	1
0	1	1	0	0	0	0	0	0	0	0	0
0	1	1	1	0	0	0	0	0	0	0	0
1	0	0	0	0	1	1	0	1	1	0	1
1	0	0	1	0	1	1	1	1	1	0	1
1	0	1	0	1	1	1	0	0	0	0	1
1	0	1	1	1	1	1	1	0	1	0	1
1	1	0	0	0	0	0	0	1	1	1	1
1	1	0	1	0	0	0	0	1	1	1	1
1	1	1	0	1	0	1	0	0	0	0	1
1	1	1	1	1	0	1	1	0	1	1	1

Convert the truth table to a Karnaugh map

AB \ CD	00	01	11	10
00	0	0	0	0
01	1	1	0	0
11	1	1	1	1
10	1	1	1	1

Circle the groupings of 1’s to create the SOP expression

AB \ CD	00	01	11	10
00	0	0	0	0
01	1	1	0	0
11	1	1	1	1
10	1	1	1	1

Writing the SOP expressions for the two circles gives the answer:
A + BC’

4. For the following truth table, derive the standard SOP and standard POS expressions.

A	B	C	D	Output
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

For standard SOP, we write the SOP expressions for each 1 in the truth table
A’B’C’D’ + A’B’C’D + A’B’CD’ + A’B’CD + AB’C’D’ + AB’C’D + ABCD’ + ABCD

For standard POS, we write the POS expressions for each 0 in the truth table
(A+B’+C+D)(A+B’+C+D’)(A+B’+C’+D)(A+B’+C’+D’)(A’+B+C’+D)(A’+B+C’+D’)(A’+B’+C+D)(A’+B’+C+D’)

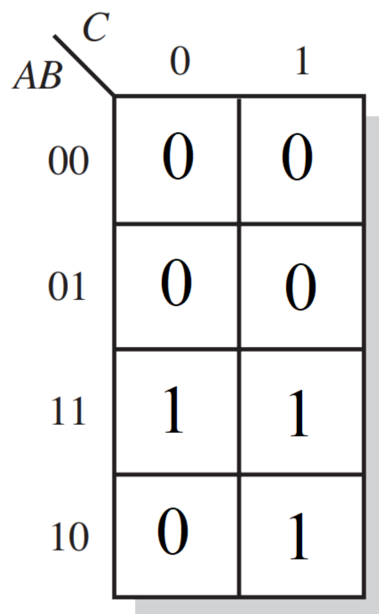
5. Create a Karnaugh map for the following expression, then find the minimum SOP expression using the Karnaugh map: (A + B’)(A + B + C’)(B + C)

This POS expression gives all of the 0 locations in the Karnaugh map. You can convert directly or create a truth table like this one.

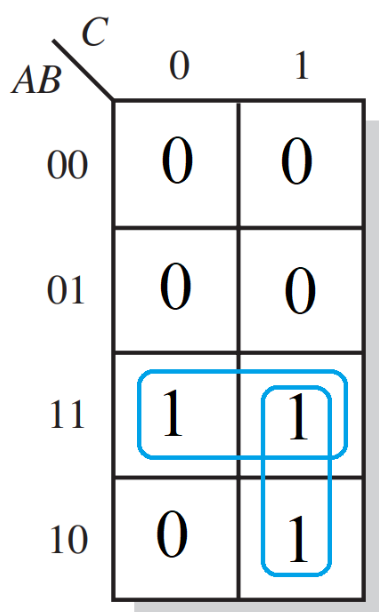
A	B	C	B’	A+B’	C’	A+B+C’	B+C	Output
0	0	0	1	1	1	1	0	0
0	0	1	1	1	0	0	1	0
0	1	0	0	0	1	1	1	0
0	1	1	0	0	0	1	1	0
1	0	0	1	1	1	1	0	0
1	0	1	1	1	0	1	1	1

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

Convert the truth table to a Karnaugh map



Circle the groupings of 1's to create the SOP expression



Writing the SOP expressions for the two circles gives the answer:
AB + AC