Bring this homework to class on Tuesday Sept. 11, but do not turn it in until the end of class.

#1. Using DeMorgan’s Theorem, express the function as indicated.
\[ F(A,B,C) = AC' + A'C' + BC' \]

a. With only OR and Complement operations:
\[ F(A,B,C) = (A' + C)' + (A + C)' + (B' + C)' \]

b. With only AND and Complement operations:
\[ F(A,B,C) = ((AC')' (A'C')')' + BC' \]

#2. In order to design a single stage logic circuit, we need to express the logic function so that only single literals are complemented [ no complemented parentheses like \((A+B)’\) ]. Express the following logic functions that way (use DeMorgan’s theorem):

\( (A' + B)'C + ((D + E')F)' = AB'C + (D+E')' + F' = AB'C + D'E + F' \)

\( (AB(C + D)')' = (AB)' + C + D = A' + B' + C + D \)

\( (((A'B)'C)'D)') = (A'B)'C + D' = A + B' + C' + D' \)

#3. For the truth tables below, express the minterm sum of products, and the maxterm product of sums:

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\[ F(A,B,C) = A'B'C + A'BC + AB'C' + ABC' = m1 + m3 + m4 + m6 \]

\[ F(A,B,C) = (A+B+C) (A+B’+C) (A’+B+C’) (A’+B’+C’) = M0 M2 M5 M7 \]
#3. For the truth tables below, fill in the Karnaugh map

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\[ A, BC \]  
\[ \begin{array}{cccc}
00 & 01 & 11 & 10 \\
0 & 0 & 1 & 1 \\
1 & 1 & 0 & 0 \\
\end{array} \]

minterm indices ___1, 3, 4, 6____ [for all 1’s, index = 4A + 2B + C]
maxterm indices ___0, 2, 5, 7____ [for all 0’s, index = 4A + 2B + C]

#4. For the Karnaugh map below, circle the Prime Implicants and label the Essential Prime Implicants with “EPI”.

![Karnaugh Map Diagram]

EPI = B'D'
EPI = A'C'
EPI = BC'D

Write the reduced logic expression:  
\[ B'D' + A'C' + BC'D + AB'C' \]  
[AC'D could replace AB'C']

maxterm indices (decimal)  
_1, 4, 11, 12, 14, 15_
#5. Express the following as a sum of products (minterms) and as a product of sums(maxterms).

\[ F(A,B,C) = (AB' + BC) (AC + AB'C) \]

\[ = AB'AC + AB'AB'C + BCAC + BCAB'C \]

\[ = AB'C + AB'C + ABC + 0 \]

**SOP:**

\[ = AB'C + ABC \]

\[ = m5 + m7 \quad [101, 111] \]

\[ F(A,B,C) = (AB' + BC) (AC + AB'C) \]

\[ = (AB' + B) (AB' + C) (AC + AB') (AC + C) \]

\[ = (A + B) (A + C) (B' + C) A (C + B') C \]

\[ = (A + B) (A + C) (B' + C) (C + B') A C \]

\[ = (A + B) (A + C) (B' + C) (C + B') A \_C \]

\[ = (A + B) = (A+B+C)(A+B+C') \]

\[ A = (A+B+C) (A+B+C') (A+B'+C) (A+B'+C') \]

\[ = (A+B+C)(A+B+C')(A+B'+C) (A+B'+C') \]

\[ = (A+B+C)(A+B+C)(A+B'+C) (A+B'+C') \]

\[ = (A+B+C)(A+B+C) (A+B'+C)(A+B'+C') \]

**POS**

\[ = (A+B+C) (A+B+C) (A+B'+C) (A+B'+C') \]

\[ = M0 M1 M2 M3 M4 M6 \]